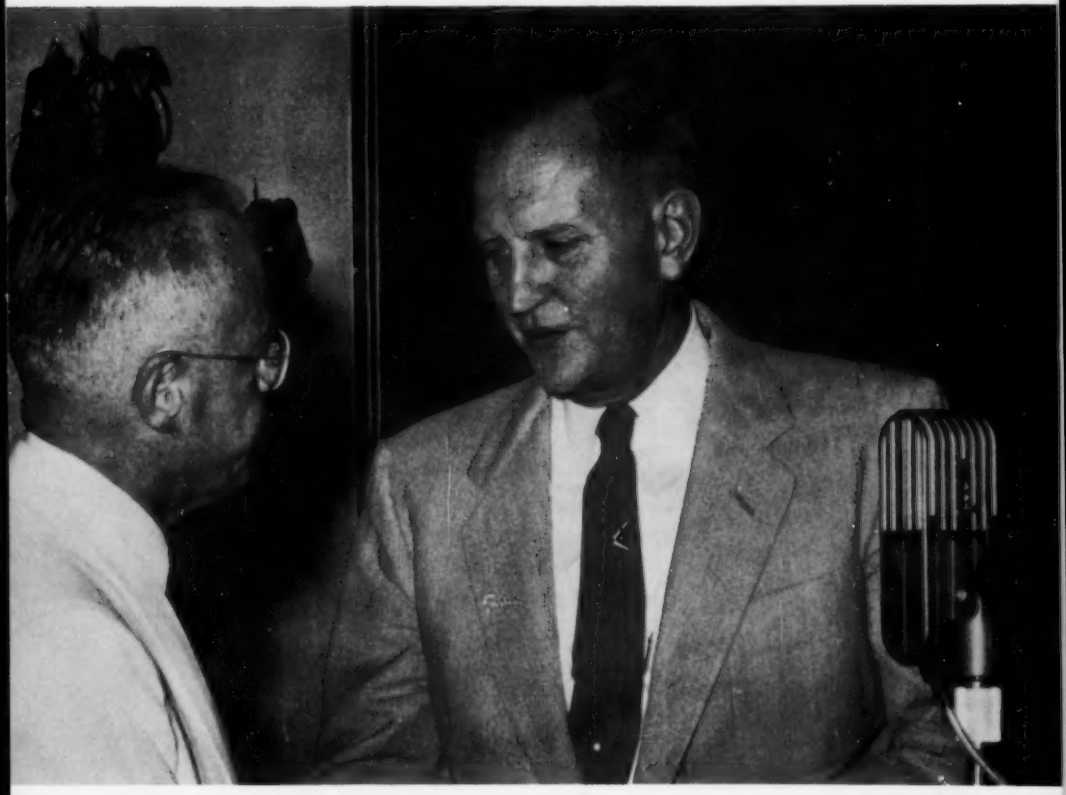
THE JOURNAL
OF THE
AMERICAN LEATHER CHEMISTS ASSOCIATION

VOL. LII AUGUST 1957 No. 8



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The Journal

of the

AMERICAN LEATHER CHEMISTS ASSOCIATION

Vol. LII AUGUST 1957 No. 8

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Cover picture courtesy of The Leather Manufacturer.

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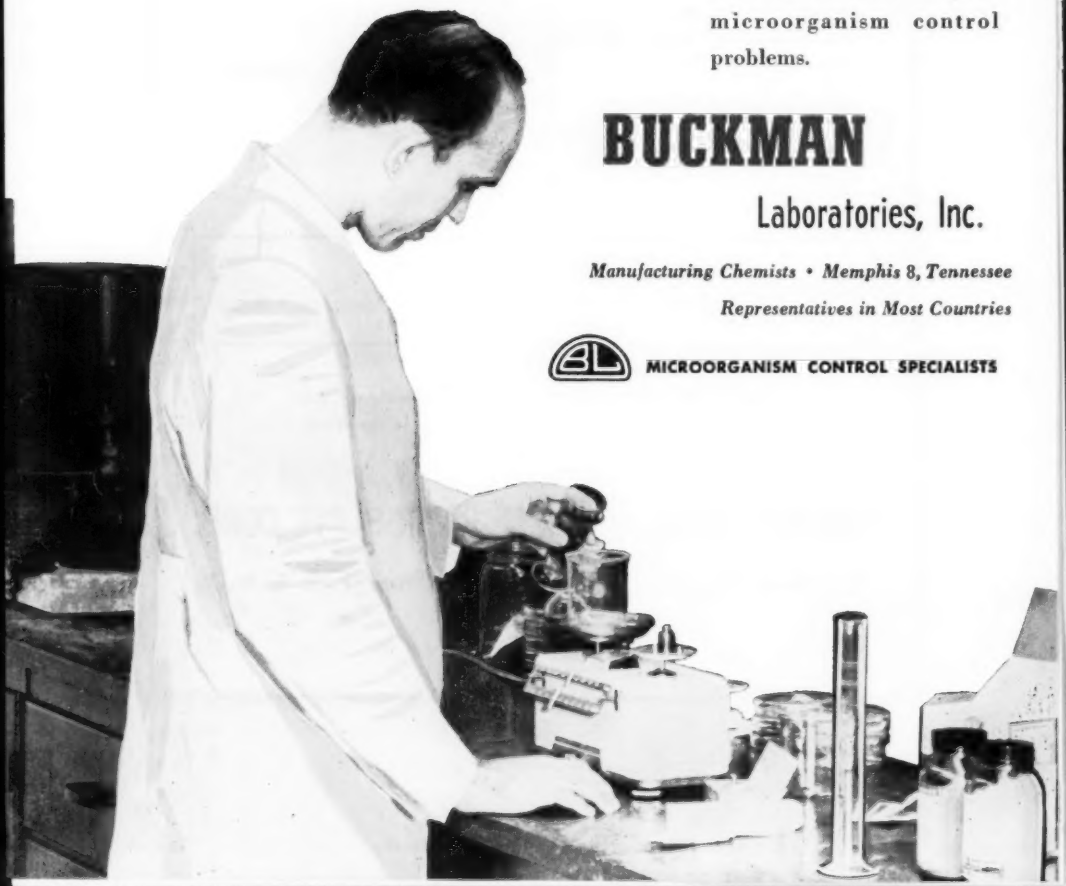

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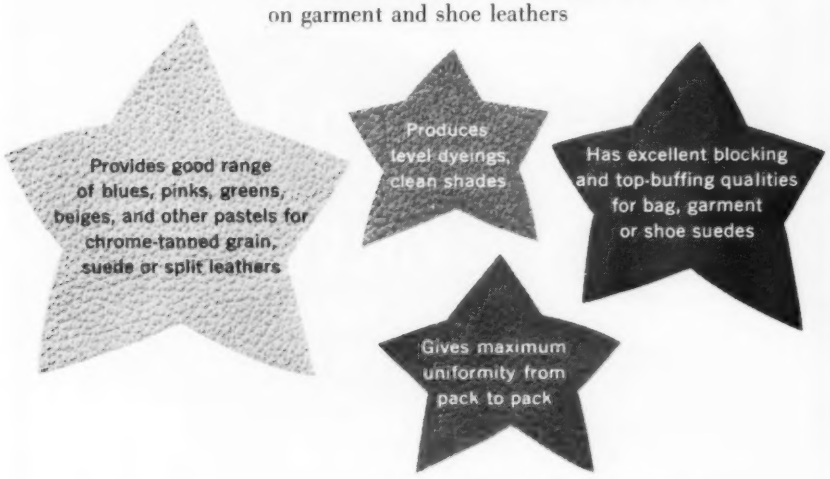
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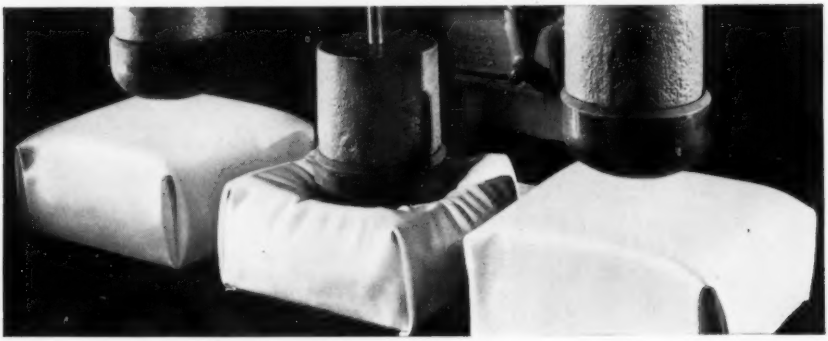

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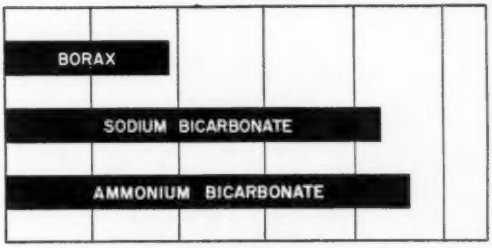

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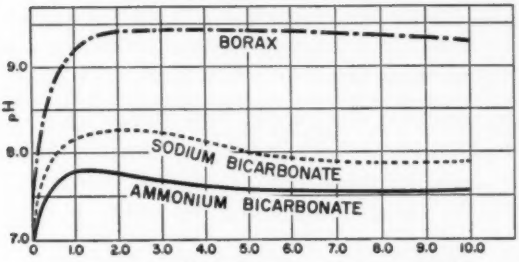
at Lower pH for



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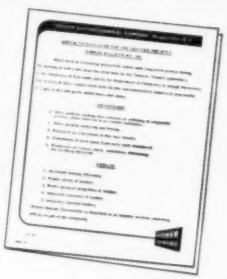

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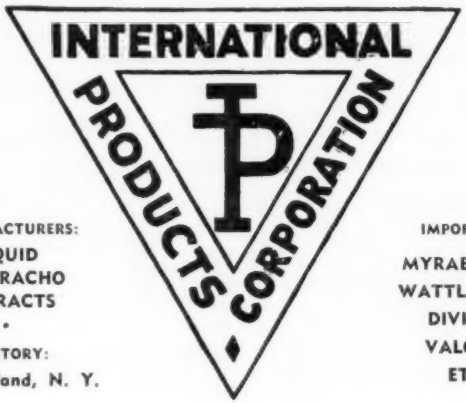

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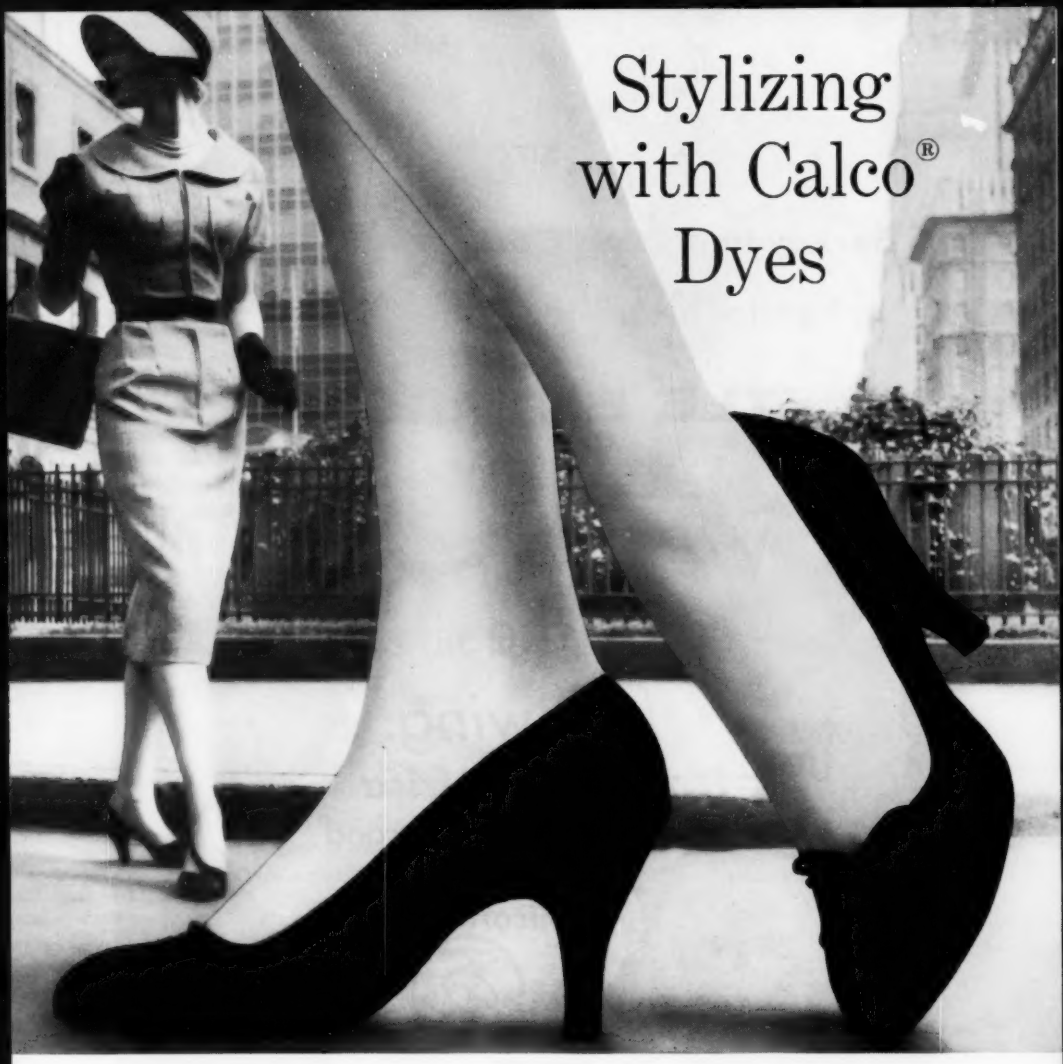

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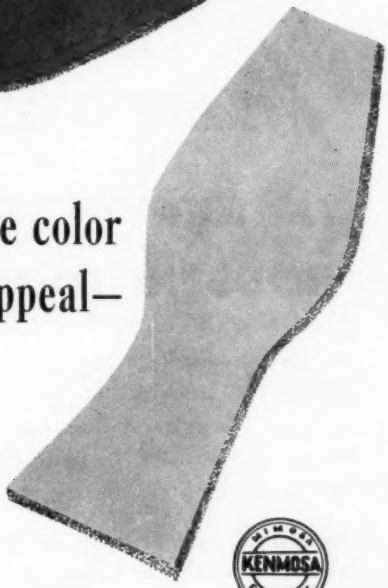

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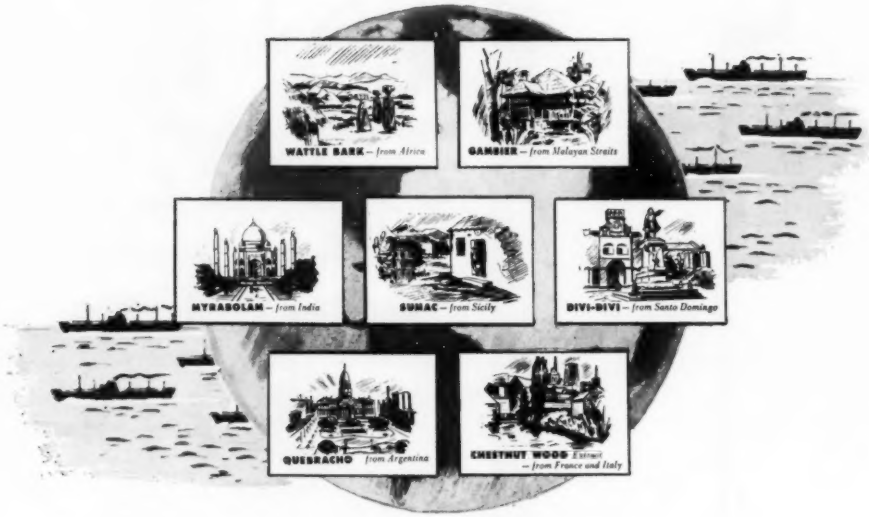
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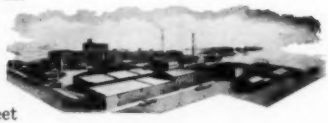

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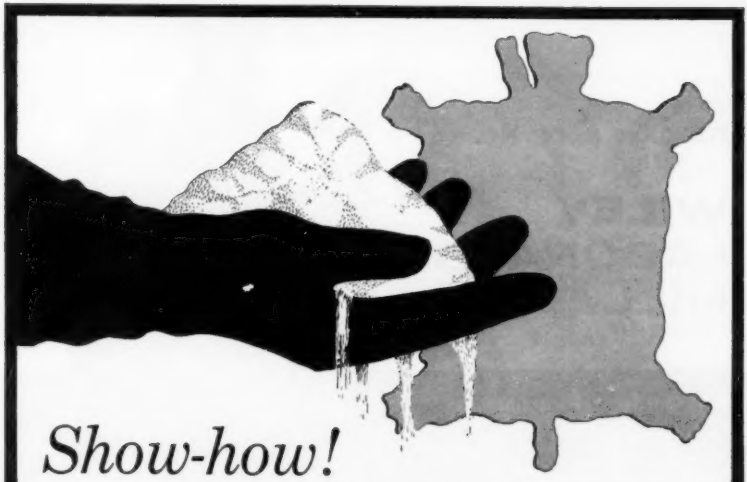

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General correspondence concerning the *Journal* should be mailed to the Managing Editor.

Subscriptions—$12 per year for members; $15 for nonmembers.

A LABORATORY METHOD FOR MEASURING EFFECTS OF PROCESS VARIABLES ON LEATHER QUALITY

I. SELECTION OF SAMPLES FOR LABORATORY EXPERIMENTS*

HERBERT J. HODUS** AND ROBERT STUBBINGS

Lehigh University
Bethlehem, Pennsylvania

ABSTRACT

Samples for experimental studies of leather process variables may be chosen in many different ways, such as random samples from a single side or skin, random samples from one general area of a single skin, random samples from the same area of many hides or skins, paired samples taken immediately adjacent to each other, paired samples taken from the same areas of the right and left sides of the skin, and various Latin and Graeco-Latin square sampling from a large area of a single skin. These methods have been carefully studied statistically in order to find out which methods are most sensitive and most reliable for evaluating the effects of process changes.

By far the best sampling method turned out to be matched pairs chosen symmetrically with respect to the backbone and taken either from many areas of a single hide or skin or from many hides or skins. At least 20 pairs of samples must be taken precisely symmetrical to the backbone, individually marked for later identification, and divided into an experimental and control lot by some prearranged plan whereby both control and experiment contain equal numbers of rights and lefts. The pairs can be selected in several ways with little effect on the reliability of the results, i.e., cut from the same position of many hides, cut from many positions on one hide, or any combination of these. The choice of the positions to be used depends upon the experimental variable being studied and upon the interpretation to be placed on the results.

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INTRODUCTION

The leather research technologists of today need a reliable laboratory method for the evaluation of tanning process changes as to their effects on

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leather quality, including the subjective qualities such as fullness, fineness of break, freedom from drawn grain, and temper, as well as the objective qualities based on chemical and physical tests. There is no laboratory method presently available which can produce results comparable to full-scale tannery production, especially when the same procedures and formulas are used in the laboratory as in the tannery.

There are many reasons for the failure of present laboratory methods to conform to tannery results, such as improper selection of samples for experimentation, failure of small-scale equipment to duplicate tannery drum action, and insensitive and biased techniques for evaluating the leather. This paper will deal with the problem of proper selection of samples for laboratory experimental studies, and a following paper will deal with the experimental equipment and evaluation of results.

DESIGN OF EXPERIMENTS

The methods used for increasing the sensitivity of experiments may be broadly classified into three types. The first is to increase the size of the experiment either through the provision of more replicates or by inclusion of additional treatments. The second is to refine the experimental technique. The third is to handle the experimental material in such a manner that the material to which one treatment is applied is closely comparable with that to which another is applied.

The method generally used by the technologist to select samples for laboratory experimentation is to cut small pieces at random from a hide, and to use some of these for the experiment and the remainder for the control. This type of selection is poor, due to the nonhomogeneity of the hide, and therefore various experimenters have turned to statistical designs available for use on nonhomogeneous materials.

One of the first designs used was the random type. The essence of this design is to select samples from over the whole area of the hide or from various selected positions such as shoulder, butt, or belly strips, or the official sampling positions. These samples are then distributed at random to the test or control. This design has been used by many workers in the field (1–8).

A design that has been frequently used is the factorial design. Through the use of this design an experiment may be arranged so that the treatment effects may be subdivided and analyzed to show the effects of several factors (9–12). A refinement in sampling for a factorial design was accomplished by Moore (13) by using a careful positional block design to insure that each test variable was carried out on samples coming from all possible positions on the hide. She used 18 hides, selecting one sample from each hide to make up 18 pieces for each test, and made sure that one of these pieces came from each of the 18 different sampling positions.

Another type of design that has been used frequently is the block type, which includes the random block, balanced incomplete block, Latin square, quasi-Latin square, and Youden square. A block design is more useful than either a random or a factorial design when experimenting on nonhomogeneous materials. Since animal hide is particularly nonhomogeneous over its entire area and between skins, block designs seem particularly suited to experimental work in leather problems and many workers have made use of these designs (14–24).

The general symmetry between the left and right sides of animal skins is well recognized by both tanner and technologist, yet very little experimental work has been done utilizing this principle of symmetry. A block design may be modified to take advantage of this symmetry by choosing pairs of samples symmetrically located with respect to the backbone. Spiers (25, 26), as far back as 1931, carefully analyzed the data available to him and concluded that the matched pair method should be useful if samples were very carefully selected from the two sides of the animal. A few investigators (27–30) have used this matched pair design but unfortunately analyzed their data as if it were from a random design and therefore lost all the advantage to be gained from matched pair data. Modified "pair" designs using *adjacent* small samples have been used by various investigators (31–35). A review of methods of sampling for laboratory experimentation was presented by Mitton (37), but unfortunately he did not include matched pair designs.

Lollar and Wilson (36) used matched sides in a full-scale tannery test and performed the leather evaluation by a comparison of each control side against its experimental mate. This same method for tannery tests has been used by the Lehigh laboratory for a number of years with generally good correlation between tanneries. It would seem that this technique therefore should have value in laboratory experimental work.

STATISTICAL EVALUATION OF BLOCK DESIGNS

There are many types of statistical designs available for use in sampling, and the selection of any one of them depends on the nonhomogeneities expected and also upon practical and economic considerations. After careful study of the available designs, the randomized block design appeared to be the best design for a nonhomogeneous material such as hides. The essence of this design is to select blocks that are as homogeneous as possible. Three different ways to set up a randomized block design on hides are:

(*a*) plots taken symmetrically located with respect to the backbone,

(*b*) plots taken adjacent to each other parallel to the backbone, and

(*c*) plots taken adjacent to each other perpendicular to the backbone.

In order to determine which of the above designs is best for laboratory work on leather variables it is possible to take data from the literature and set up dummy tests in the three ways shown above and then evaluate these systems as to their ability to detect small differences in leather qualities. This was done by taking Wilson's data (38) (Figure 1) showing the tensile strength over the entire area of a calfskin. Since Wilson's specimens were 1″ x 6″ rectangles, and since we considered that the smallest specimen that could be adequately evaluated for subjective leather qualities was about 4″ x 4″, we grouped 4 of Wilson's samples to form 4″ x 6″ rectangles as shown in Figure 2. The assignment of samples to either the "experiment" or "control" in the dummy test was done at random, taking care that approximately an equal number of lefts and rights fell into the experimental and control groups. This is illustrated for method (*a*) above in Figure 2, where E1 corresponds to C1, etc.

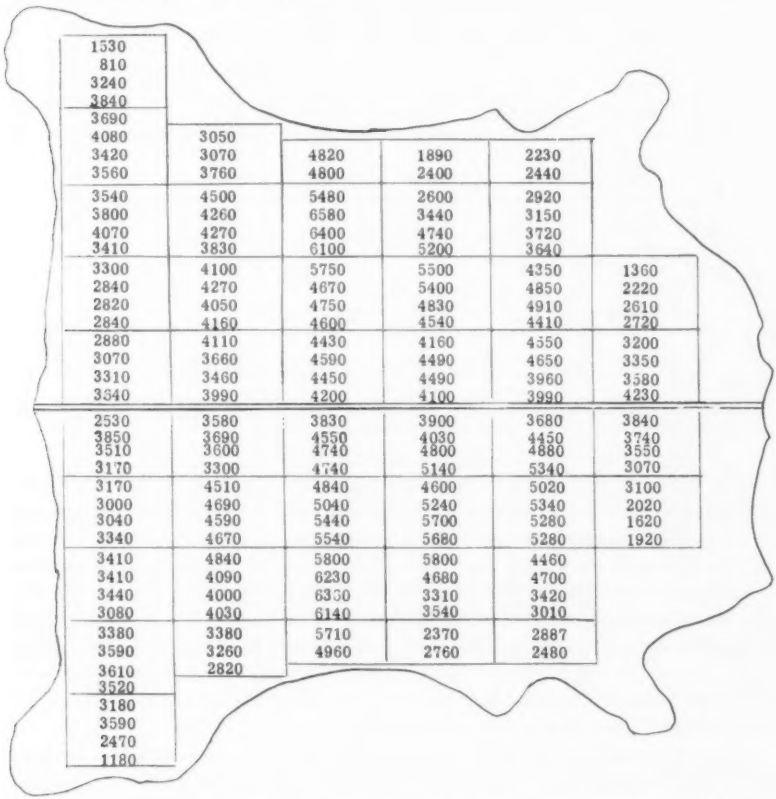

FIGURE 1.—Tensile strength (lbs/sq. in.) over the area of a chrome-tanned calfskin. 1″ x 6″ strips taken parallel to backbone.

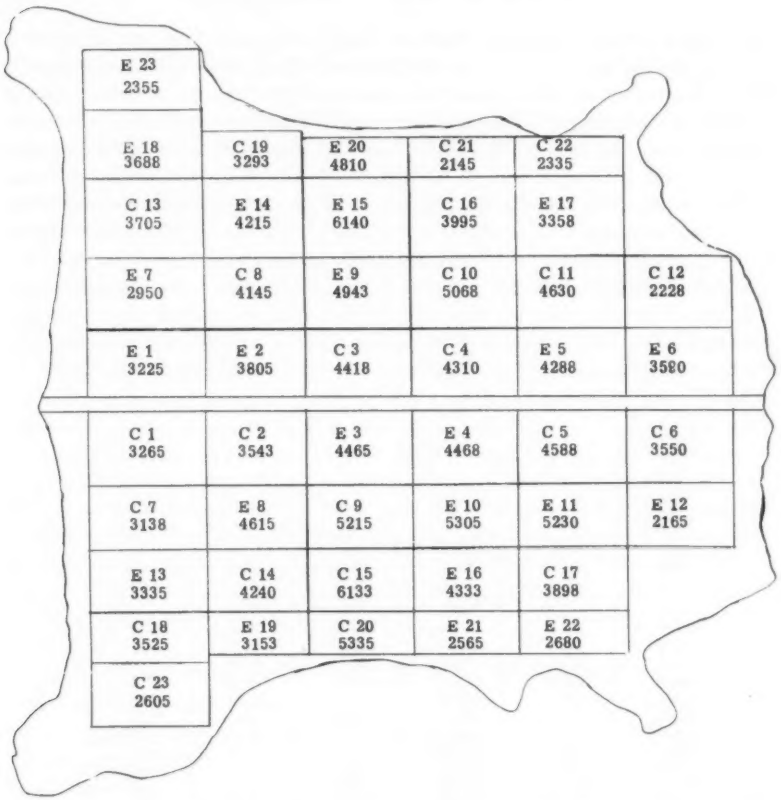

FIGURE 2.—Tensile strength (lbs./sq. in.) over the area of a chrome-tanned calfskin. Average of four 1" x 6" strips taken parallel to backbone.

The sampling for adjacent matched pairs taken parallel to the backbone was done in a similar manner except that the columns of data for the tail and head portion were eliminated to give the best possible matching for this design as shown in Figure 3a. The adjacent matched pairs taken perpendicular to the backbone were done in the same manner, but the two plots in the rear flank area were eliminated as shown in Figure 3b. The numerical analysis for the symmetrical matched pair variance is shown in Table I along with the sample calculations. This method for variance analysis is shown in detail by Villars (39) and differs considerably from the more usual "between" and "within" treatments variance analysis.

From the variance analysis it is possible to calculate either the number of samples needed to show some specified difference between an experi-

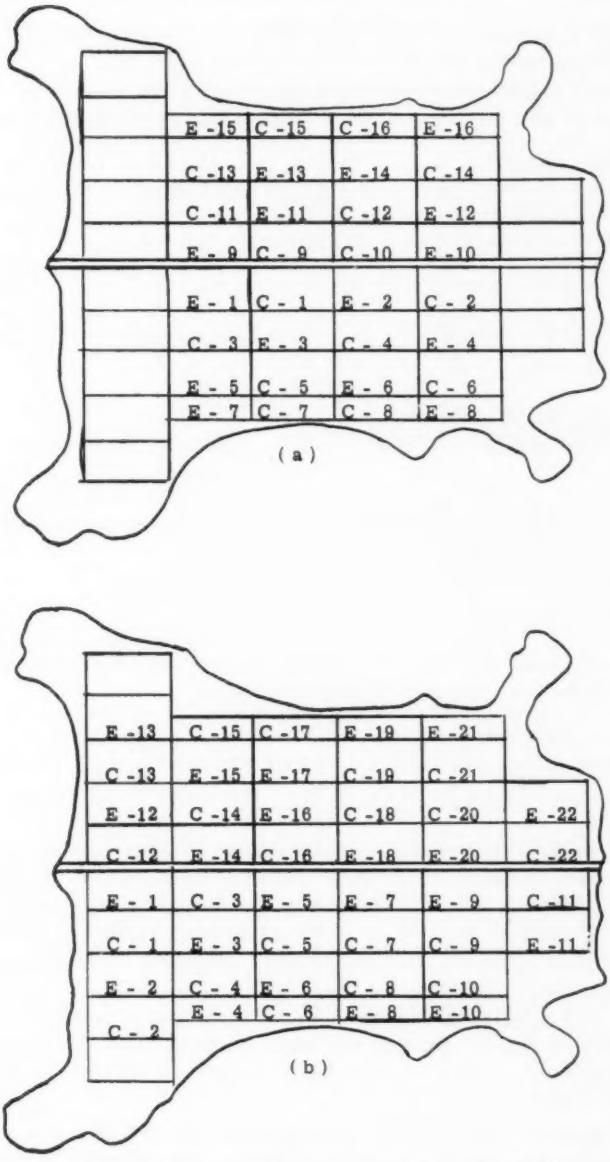

FIGURE 3.—Samples for adjacent matched pairs taken (*a*) parallel to backbone, and (*b*) perpendicular to backbone. (See Figure 2 for tensile strength.)

ment and a control or to show the minimum difference measurable for a given number of samples taken.

A sample calculation for determining the number of pairs at $t = .05$ for matched blocks which have been individually identified as follows:

$$t = \frac{x}{s_x \sqrt{\frac{2}{n}}} \qquad t = \text{Significance level}$$

$$n = 2\left(\frac{t}{x}\right)^2 s_x^2 \qquad x = \text{Smallest difference observable}$$

$t_{.05}$ for 22 degrees of freedom $= 2.080$ $\qquad n = \text{Number of samples to be determined}$

$$n = 2\left(\frac{2.07}{200}\right)^2 49{,}005 \qquad s_x = \text{estimate of standard deviation}$$

$$n = 11$$

Using the same formula, we calculate the smallest observable difference obtainable for the average of 25 pairs of samples:

$$x = t\, s_x \sqrt{\frac{2}{n}} \quad \text{or} \quad x = (2.07)(222)\sqrt{\frac{2}{25}} = 132 \text{ lbs/sq. in.}$$

In Table II we show several methods of comparing test designs, including the standard deviation of the error term (which represents the deviation between each piece of a pair taken on the average over all pairs), the number of pairs of samples required to show an arbitrary difference between the experiment and control, and the smallest difference observable using 25 matched pairs.

If we had failed to identify individually each pair of samples, we would not have been able to eliminate the block-to-block error and would have gotten the result shown in the column of Table II labeled "Unidentified Matched Pairs".

It is apparent from Table II that the most sensitive design is the symmetrical matched pair block design, with the two adjacent block designs being next best, and the unidentified matched pair design being the worst.

TABLE I

MATCHED PAIR VARIANCE ANALYSIS

(Pairs taken symmetrically with respect to backbone from Figure 2)

Grand total (total of all 46 entries) 178,988
Treatment totals (total of 23 C values, 89,307; 23 E values, 89,681)
Block Totals, C1 + E1 = 6490, C2 + E2 = 7348, ... C23 + E23 = 4960

Square and Sum	The 46 Entries	The Two Treatment Totals	The 23 Block Totals	The Grand Total
Result	743,609,334	16,018,422,010	1,485,056,148	32,036,704,144
Divide by	1	23	2	46
Quotient	743,609,334	696,453,130	742,528,074	696,450,000*
Subtract	696,450,000	696,450,000	696,450,000	
Remainder	47,159,334	3,130	46,078,074	

ANALYSIS OF VARIANCE

Source	Sum of Squares	Degrees of Freedom	Mean Squares	Standard Deviation
Between treatments	3,130	1	3,130	
Between blocks	46,078,074	22	2,094,457	
**Within blocks	1,078,120	22	49,005	222
Total	47,159,334	45		

*Correction term
**This is the matched pair variance estimate

TABLE II

ANALYSIS OF VARIANCE OF A CHROME-TANNED CALFSKIN OVER THE AREA OF THE SKIN FOR 1″ x 6″ TENSILE STRENGTH SPECIMENS TAKEN *PARALLEL* TO THE BACKBONE

(4 tensile strength specimens averaged to form a 4″ x 6″ plot)

	Symmetrical Matched Pairs (Across Backbone)	Adjacent Matched Pairs Taken Parallel to Backbone	Adjacent Matched Pairs Taken Perpendicular to Backbone	Unidentified Matched Pairs (Across Backbone)
Standard deviation of error term (lbs/sq. in.)	222	755	645	1035
Number of pairs needed to show 200 lbs/sq. in. difference between experiment and control	11	127	87	217
Smallest difference observable in lbs/sq. in. for 25 pairs of samples	130	456	379	604

This conclusion is, of course, based on the data from a single calfskin, and in order to confirm these results the data from three more calfskins were analyzed in the same manner. These data are shown in Table III, IV, and V, and confirm the conclusions established in Table II.

The average ratios of sensitivity for these four sets of data are shown in Table VI.

These data in Table VI show beyond doubt that the symmetrical matched pair method for forming blocks is by far the most effective.

TABLE III

ANALYSIS OF VARIANCE OF A CHROME-TANNED CALFSKIN OVER THE AREA OF THE SKIN FOR 1" x 6" TENSILE STRENGTH SPECIMENS TAKEN *PERPENDICULAR* TO THE BACKBONE

(4 tensile strength specimens averaged to form a 4" x 6" plot)

	Symmetrical Matched Pairs (Across Back-Bone)	Adjacent Matched Pairs Taken Parallel to Backbone	Adjacent Matched Pairs Taken Perpendicular to Backbone	Unidentified Matched Pairs (Across Backbone)
Standard deviation of error term (lbs/sq. in.)	494	702	965	949
Number of pairs needed to show 200 lbs/sq. in. difference between experiment and control	54	110	213	186
Smallest difference observable in lbs/sq. in. for 25 pairs of samples	295	421	571	553

TABLE IV

ANALYSIS OF VARIANCE OF A VEGETABLE-TANNED CALFSKIN OVER THE AREA OF THE SKIN FOR 1" x 6" TENSILE STRENGTH SPECIMENS TAKEN *PARALLEL* TO THE BACKBONE

(4 tensile strength specimens averaged to form a 4" x 6" plot)

	Symmetrical Matched Pairs (Across Back-Bone)	Adjacent Matched Pairs Taken Parallel to Backbone	Adjacent Matched Pairs Taken Perpendicular to Backbone	Unidentified Matched Pairs (Across Backbone)
Standard deviation of error term (lbs/sq. in.)	540	875	662	1010
Number of pairs needed to show 200 lbs/sq. in. difference between experiment and control	62	165	95	213
Smallest difference observable in lbs/sq. in. for 25 pairs of samples	320	519	387	589

TABLE V

ANALYSIS OF VARIANCE OF VEGETABLE-TANNED CALFSKIN OVER THE AREA OF THE SKIN FOR 1" x 6" TENSILE STRENGTH SPECIMENS TAKEN *PERPENDICULAR* TO THE BACKBONE

(4 tensile strength specimens averaged to form a 4" x 6" plot)

	Symmetrical Matched Pairs (Across Back-Bone)	Adjacent Matched Pairs Taken Parallel to Backbone	Adjacent Matched Pairs Taken Perpendicular to Backbone	Unidentified Matched Pairs (Across Backbone)
Standard deviation of error term (lbs/sq. in.)	204	601	703	760
Number of pairs needed to show 200 lbs/sq. in. difference between experiment and con-control	9	80	112	119
Smallest difference observable in lbs/sq. in. for 25 pairs of samples	122	358	418	443

TABLE VI

COMPARISON OF SENSITIVITIES OF VARIOUS EXPERIMENTAL DESIGNS EXPRESSED AS THEIR RATIO TO THE SYMMETRICAL MATCHED PAIR DESIGN

(Averaged values for 4 calfskins)

	Symmetrical Matched Pairs	Adjacent Matched Pairs (Parallel to Backbone)	Adjacent Matched Pairs (Perpendicular to Backbone)	Unidentified Matched Pairs
Standard deviation	1	2.0	2.0	2.6
Number of pairs required	1	3.5	3.7	5.4
Smallest observable difference	1	2.0	2.0	2.5

STATISTICAL EVALUATION OF BLOCK DESIGNS

(Butt samples taken over many hides)

We have discussed so far only the experimental designs involving sampling over the area of a single hide. Another approach to sampling in common use in the industry today is to select samples from single positions on a hide over many hides. This is done for example in determining either chemical or physical properties of finished leather by the official American Leather Chemists

Association methods. This technique could be employed also for selecting samples for experimental studies, and could be done in several ways:

(*a*) samples from a single position on a hide taken from many hides and assigned at random to the experimental and control groups,
(*b*) same as (*a*) above but each piece cut in half and assigned to the experimental and control, and
(*c*) symmetrical matched pieces with respect to the backbone taken from a single position over many hides.

In order to test the sensitivity of these various methods, data from a large-scale matched side tannery experiment were used. Three tests were run in the tannery each using 20 matched sides per test (10 rights and 10 lefts in control; matching 10 lefts and 10 rights in experiment). Samples 1½″ x 3″ were taken from each side 8″ in from the tail root and 3″ from the backbone line. Each of these samples was individually identified as to the hide from which it came so that a matched pair variance analysis could be made on the analytical data. Each 1½″ x 3″ sample was cut in two and the fat content of each 1½″ x 1½″ piece was determined. These data were set up as symmetrical matched pairs (across the backbone) and as adjacent matched pairs (adjacent 1½″ x 1½″ samples parallel to backbone) for the purpose of variance analysis. The results are shown in Table VII.

TABLE VII

ANALYSIS OF VARIANCE OF FAT CONTENT OF CHROME-TANNED SIDE LEATHER

(*Samples from butt area*—1½″ x 3″)

	Test No.	Symmetrical Matched Pairs (Across Backbone)	Adjacent Matched Pairs (Parallel to Backbone)	Unidentified Matched Pairs (Across Backbone)
Standard deviation of error term % fat (on air-dried leather basis)	1	0.73	0.71	0.97
	2	0.48	0.55	1.25
	3	0.81	0.75	1.06
	Average	0.67	0.67	1.09
Number of pairs required to show a 0.5% difference in fat content (on air-dried leather basis)	1	19	18	31
	2	8	11	51
	3	23	21	37
	Average	16.7	16.6	39.6
Smallest observable difference for 20 pairs (% fat on air-dried leather basis)	1	0.49	0.47	0.62
	2	0.28	0.35	0.80
	3	0.54	0.50	0.68
	Average	0.44	0.44	0.70

It is apparent from the above data that the matched pair sampling is about twice as sensitive as unidentified matched pair sampling and that there is no difference between adjacent and symmetrical matched pairs. In the previous data for sampling over the entire area of a hide a large difference between symmetrical and adjacent sampling was found, and this is probably due to the difference in size of samples used in the two analyses. In the latter case very small pieces 1½″ x 1½″ were compared, whereas in the former, areas 4″ x 6″ were compared. This indicates that adjacent matched samples can be selected for experimental studies provided that the area of each piece is kept small enough (say less than 2″ x 2″) but that if a larger sample size is required (for an evaluation of subjective leather qualities), symmetrical matched sampling is a better choice.

STATISTICAL EVALUATION OF BLOCK DESIGNS

(Both positions and skins for goatskins)

Another set of data from which both unidentified matched pair and symmetrical matched pair sensitivity can be evaluated, covering both individual positions on a skin and a comparison among many skins, was published by Hamel and Roddy (29). They selected 12 samples from each goatskin (6 from the left side and 6 from the right side symmetrical with respect to the backbone line) and repeated this sampling on a total of 16 goatskins. Their samples were 2½″ x 8″ and from each of these sample pieces they cut one tensile strength dumbbell (as well as pieces for other physical and chemical tests). We have reevaluated their data for tensile strength by the variance analysis method described in Table I, for both symmetrical and identified matched pairs and for unidentified matched pairs. This was accomplished by first setting up the tensile strength data for a single position (say the front shoulder) for all sixteen skins and then proceeding with the variance analysis. This process was repeated for each of the six skin positions in turn, and the results are shown in Table VIII.

TABLE VIII

ANALYSIS OF VARIANCE OF TENSILE STRENGTH OF SIX AREAS OF A GOATSKIN

(Taken over 16 *goatskins)*

	Symmetrical Matched Pairs			Unidentified Matched Pairs		
Position	Standard Deviation	No. of Pairs Required to Show a 200 lb. Difference in Tensile Strength	Smallest Observable Difference for 25 Pairs	Standard Deviation	No. of Pairs Required to Show a 200 lb. Difference in Tensile Strength	Smallest Observable Difference for 25 Pairs
A—Shoulder	252	15	152	543	61	231
B "	288	20	174	453	43	193
C "	132	4	80	443	41	188
D "	165	7	100	445	41	189
E "	325	25	196	390	32	166
F—Butt	305	22	184	407	35	173
Average	245	16	148	443	42	190

These results confirm the previous ones, in that they show individually identified matched pairs to be from two to three times as sensitive as unidentified matched pairs for determining changes in tensile strength in goatskins.

The original data were set up in another way to test the sensitivity of matched pairs. The six matched pairs from a single goatskin were set up as a single group of data and analyzed for variance as previously described. This procedure was repeated for each of the sixteen goatskins in turn, and the results are shown in Table IX.

TABLE IX

ANALYSIS OF VARIANCE OF TENSILE STRENGTH OF SIXTEEN GOATSKINS

(Samples taken from six positions on skin)

	Symmetrical Matched Pairs			Unidentified Matched Pairs		
Skin No.	Standard Deviation	No. of Pairs Required to Show a 200 lb. Difference in Tensile Strength	Smallest Observable Difference for 25 Pairs	Standard Deviation	No. of Pairs Required to Show a 200 lb. Difference in Tensile Strength	Smallest Observable Difference for 25 Pairs
1	336	37	246	307	24	194
2	332	36	244	456	48	288
3	242	19	177	235	14	149
4	179	10	131	298	19	188
5	270	24	198	209	11	132
6	153	8	112	136	5	86
7	103	4	76	184	8	116
8	137	6	100	245	15	155
9	350	40	256	540	73	341
10	89	3	65	120	4	76
11	129	5	94	118	4	75
12	258	22	189	336	28	212
13	266	23	195	310	24	196
14	255	20	187	204	10	129
15	103	3	75	161	7	102
16	141	7	103	190	9	120
Average	209	17	153	253	19	160

The results in this case indicate very little increase in sensitivity for identified matched pairs over unidentified matched pairs. This result is at variance with all the other results reported so far, and we are not sure of the reasons for this. We think that it may be due to the particular sampling method used and to the fact that so few samples (only 6 pairs) were available for the variance analysis in this case. The samples that were used for tensile strength measurements were all taken from the middle bend area on each side of the backbone only, and this area is recognized as the most uniform area of the entire skin. Therefore either unidentified matched pairs or identified matched pairs show about the same sensitivity on a single

skin. Another reason for the lack of sensitivity of identified pairs in this case may be the fact that only one tensile strength measurement was made on each piece (thus producing additional error due to the error in the tensile determination).

OTHER DESIGNS AVAILABLE

So far we have discussed only simple matched pair block design, but many other types of experimental designs have been suggested for hide experimentation especially by the British workers (2–11). Designs such as Latin or Graeco-Latin squares have been recommended, but these designs all require a larger block than the matched pair design, and this larger block has been shown to lead to lower sensitivity.

The factorial type of design has been highly recommended, but the reports of this type of design have not included any matched pair data and have used only 8 replications at most, which we have shown to be highly insensitive even for matched pair testing. It would seem that we should prove that our experimental methods work for the simplest case (experiment versus control) before we try to find the second and third order interactions between variables. If we can demonstrate conclusively and repeatedly that we can find a real difference between an experiment and a control (where the variable is kept within practical tannery limits), then, of course, a factorial experiment should be attempted (probably using matched pairs). If this were successful then we would have a basis upon which to test the factorial design without matched pairs.

CONCLUSIONS ON DESIGN OF EXPERIMENTS

We have demonstrated that a symmetrical matched pair block design is the most sensitive of the available experimental designs for laboratory evaluation of leather qualities. We believe that for a valid evaluation of leather qualities to be made it is more important to take samples from many areas of a hide than to take samples from a single area of many hides. By doing this we can determine the effects of the variable on belly, flank, neck, butt, etc., which we consider more important than learning the effects on a single area of the skin. We further consider that the smallest area which can be adequately evaluated for subjective leather qualities (such as break) is a piece about 4″ x 4″, and therefore all of our sampling for the investigations reported in another paper on the effect of process variables on leather quality have been done on samples of this size.

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A LABORATORY METHOD FOR MEASURING EFFECTS OF PROCESS VARIABLES ON LEATHER QUALITY

II. LABORATORY-SCALE EXPERIMENTS AND ASSESSMENT OF LEATHER QUALITY*

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ABSTRACT

A machine for duplicating the action of large-scale tannery drums on small hide pieces was developed, depending mainly upon a high-speed vertical oscillatory motion but also including provisions for adding reagents while shaking, continuous throughout washing at controlled temperature and rate of flow, and externally regulated heating or cooling. A staking machine and photometric area-measuring machine were also developed for use with small samples.

Two series of tests were run using the laboratory method described above: one with the basicity of the chrome liquor as the variable, and the other with the pH of neutralization following chrome tannage as the variable. The results of these small-scale tests were compared with full-scale tannery tests of the same variables, and the results in terms of break and temper of the leather agreed relatively closely with the tannery results.

—x—x—

INTRODUCTION

In the preceding paper the authors described a method for taking laboratory-size samples (4″ x 4″) in such a way that an evaluation of leather qualities could be accurately and sensitively performed. The process involved using matched pair samples and maintaining the identity of each half of the matched pair throughout the experimental procedure.

In this paper this sampling technique has been used to study the effects of tanning variables on leather qualities in laboratory-scale equipment. The laboratory tanning equipment and techniques have been especially developed to allow as close a correspondence to tannery results as possible. Using the equipment in its final design form, it is possible to duplicate tan-

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**Mr. Hodus offered this paper to the Graduate Faculty of Lehigh University in partial fulfillment of the requirements for the M. S. degree in Chemistry.

nery formulas as regards float ratios, reagent percentages based on hide weight, temperatures, and times; and to produce leather effects closely paralleling industrial experience. The entire process is described in detail in this paper, and it is hoped that this general procedure will make possible laboratory investigations of any tannery process variable with reliable results in terms of tannery large-scale practice.

Design of laboratory tanning equipment.—Some previous work has been done in designing laboratory equipment to make leather in the laboratory as in the tannery. Loud in 1906 (1) designed a 1-gallon laboratory rotating shaker for experimental work, and devices of this type as well as small drums have been used ever since by leather technologists. An improvement in this kind of equipment was built and reported by Morash and Trembeth in 1947 (2). Their tumbling units had provisions for continuous hot and cold water washing while running, continuous or intermittent reagent feed, and means of controlled heating. The ability of this machine to duplicate tannery leather is not known since no results in terms of leather quality have been published. Hough in 1948 (3) described a rotating jar tanning mill employing glass rods or beads to produce mechanical action on the stock and make possible the use of low floats. Bottles were rotated parallel to their long axis at about 40 to 60 rpm. He reported that successful dyeings had been carried out with this apparatus but noted that leather or hide pieces stuck to the side of the bottle and could find no remedy for this.

Kenzie and Wilson (4) developed a stainless steel tanning cylinder which rotated end-over-end in a tank of water. The cylinder was driven by an arrangement of cams which stopped it for a few seconds each time it reached the vertical position allowing the contents to fall a height of three feet. Rubber-covered balls were put in the cylinder to simulate the pounding action of a tannery drum. This machine has been successfully used for experimental retanning, coloring, and fatliquoring.

The reason that the small drum and rotary bottle types of laboratory equipment are neither reliable nor adequate for obtaining results comparable to tannery practice is that they are not capable of producing the pounding action of full-scale drums. For our work a laboratory tanning machine was developed that produces the pounding action of a production drum, similar in principle to a vertical oscillating bottle shaker developed by the DuPont Company (5). In addition a small sample staking machine has been developed and a laboratory photometric area-measuring instrument has been built.

Evaluation of leather quality.—Another problem facing the laboratory technologist is how to evaluate the results of tests in terms of leather qualities important to the tanner (most laboratory tests have concerned them-

selves only with evaluation by *objective* physical or chemical tests). A method was developed to allow for evaluation of subjective "leather qualities" without bias. To do this each pair was individually coded so that the sorter did not know which was the control or the experimental sample. The only decision the sorter had to make was which half of each pair was better in terms of the particular leather quality being evaluated. This method has high sensitivity due to the fact that it is easier to differentiate between single matched pairs than between the average value of two piles of samples.

Over the past few years the Lehigh laboratory has worked on the various phases of this problem, and now we feel that we have developed a workable technique for selecting, producing, and evaluating experimental leathers in terms of leather quality. This method greatly improves the reliability of laboratory testing and also reduces the time and cost per test.

DESIGN OF LABORATORY PROCEDURES AND EQUIPMENT

Development of tanning machine.—The basic problem in the laboratory method was the need for the development of a tanning machine which would allow us to duplicate tannery drum processing and also minimize the variables of processing. The machine had to be of a design that would impart the same mechanical action to small pieces of hide as a drum imparts to sides. The Lehigh laboratory has developed a vertical high-speed oscillator based on a bottle shaker developed by the E. I. Dupont Company (5) and used in their leather dyeing laboratory. The Lehigh shaker consisted of a 1932 Studebaker in-line eight-cylinder engine in which the alternate cylinders had been removed. A piece of channel iron was mounted on each remaining cylinder, and the tanning boxes were fastened to this. The engine is driven by a three-horsepower electric motor at 308 rpm.

This machine had to be redesigned in order to fulfill all the following conditions and permit the following necessary procedures to be carried out during actual operation:

1. Continuous hot or cold water washing
2. Measurement of the amount of water used
3. Continuous or intermittent reagent addition
4. Continuous or intermittent liquid discharge
5. Method of sampling effluent
6. Resist corrosion of various chemicals used in tanning
7. Tanning boxes must be large enough to contain approximately twenty-five 4″ x 4″ squares in order to perform statistical evaluation.

The boxes were held tight to the channel by a three-bar linkage which in the engaged position held the boxes firmly to the channel. In the open position the boxes were easily slid from underneath the linkage. The tanning boxes were constructed to hold thirty 4″ x 4″ pieces (7½″ high, 4½″ wide,

12″ deep) and were rubber-lined to handle tanning chemicals. The boxes were provided with two openings in the lids which were connected by snap-on fittings to flexible rubber hoses for feeding reagents or water into the boxes while they were being agitated. A diagram of the tanning machine is shown in Figure 1, and a picture in Figure 2.

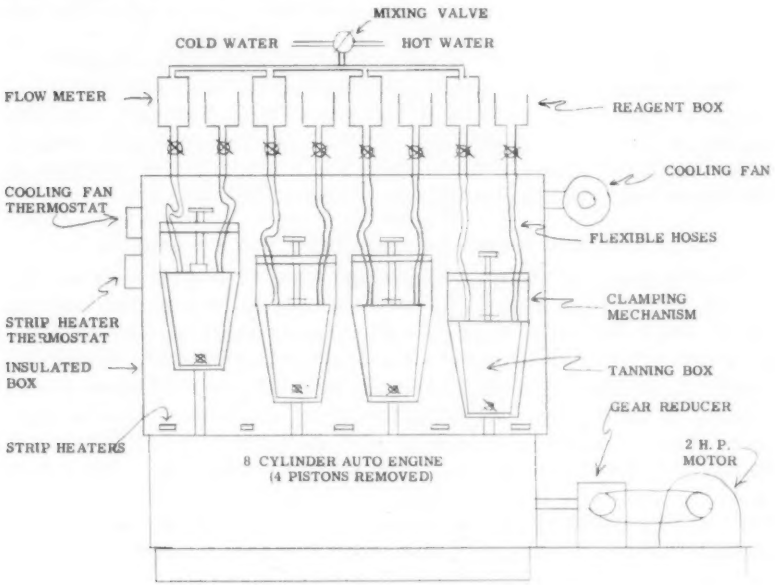

FIGURE 1.—Line diagram of the tanning machine.

The piping was so arranged that cold or hot water was mixed in a shower mixing valve. The rate of flow was controlled by individual needle valves and a flow rate meter to each unit. A thermometer was placed in the bypass line in order that the water could be brought to the desired temperature before it was added to the boxes. A thermometer was also mounted in each feed pipe. A valve was provided in the bottom front of the box to which a hose was attached so that discharge of effluent or sampling could be accomplished. The float volume during washing was held constant by regulating the input flow at 30% on the flowrator.

A cabinet 40″ long x 30″ wide x 25″ high was mounted on top of the engine. The cabinet was insulated in order that the temperature of the box could be controlled through the use of five 500-watt strip heaters spaced along the bottom of the box. These heaters were regulated by a thermostat and relay circuit. A cooling fan was controlled by another thermostat and

relay circuit. With this equipment the temperature could be kept constant in the box.

This machine can be used for all the customary tanning operations from bating to fatliquoring and dyeing. The present procedure uses up to 1500 grams of stock and 3000 milliliters of liquid in the box.

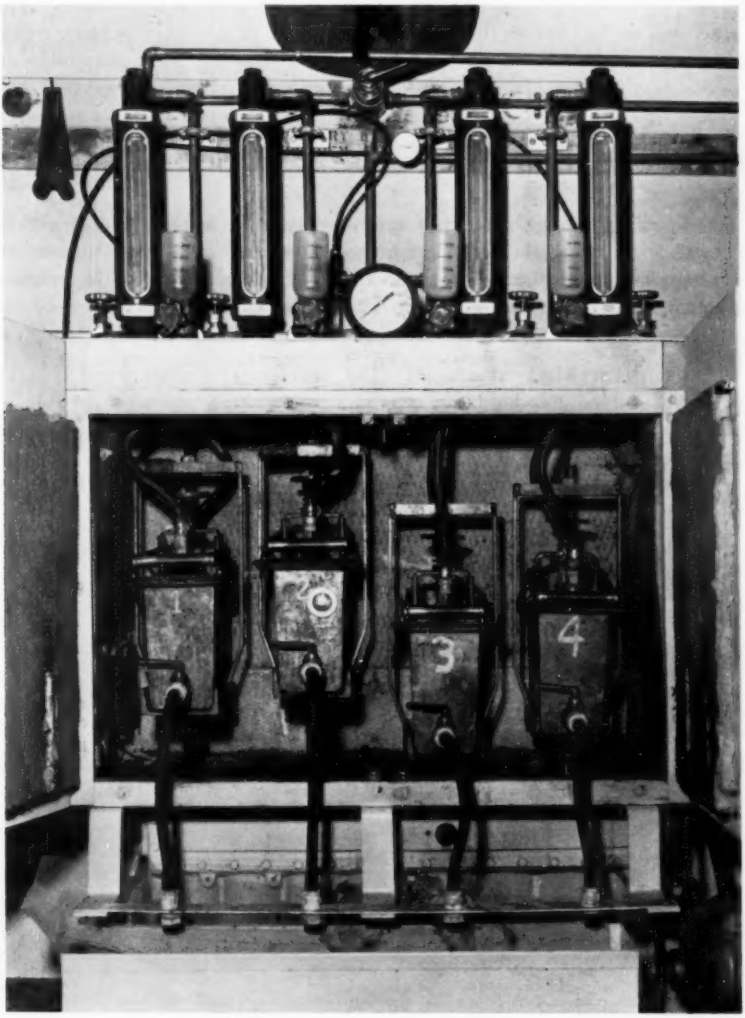

FIGURE 2.—Front view of the tanning machine.

Pasting, drying, and conditioning.—The leather, after coloring and fatliquoring, was mulled in a special high-humidity cabinet overnight and then wrung out twice between paper towels through a washing machine wringer to bring the moisture content down to the proper level for pasting.

The leather was pasted out on glass plates using a vegetable adhesive (Evans "Quick-Stick") applied to both the leather piece and the plate. The leather was slicked out on the plate by means of a rubber photographic roller.

Drying was done in an air tunnel which acted as the inlet plenum to an air-conditioning unit operating at 72° F. and 45% relative humidity. The air velocity through the tunnel was approximately 800 c.f.m. distributed over about 4 square feet of area. The plates were placed on horizontal shelves in the tunnel so that the air was evenly distributed over the flesh surfaces.

Conditioning prior to staking was accomplished by wetting and scrubbing the surface of the leather pieces to remove the paste, and then suspending the pieces individually in a forced air humidity cabinet held at 90% relative humidity and 72° F. for 24 hours. This treatment brought the leather to the proper moisture content for staking.

Design of staking machine.—The problem of staking small 4″ x 4″ pieces was solved by designing a laboratory staking machine capable of uniformly staking the leather piece. This machine operates by pulling the leather between a metal staking blade and a roller under controlled pressure. A full cycle of this machine is described below, and a picture is shown in Figure 3:

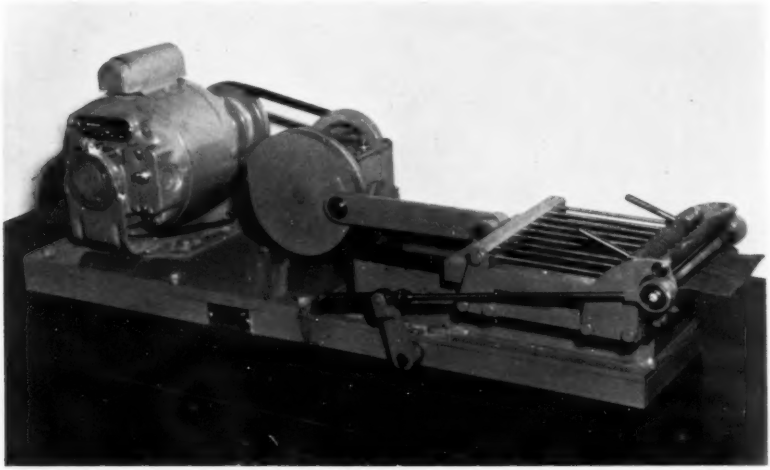

FIGURE 3.—The staking machine.

(*a*) The leather sample is positioned between stationary horizontal fingers and clamped to a horizontal movable carriage. The leather extends out over a standard staking blade. A roller is held by a cam in the up position away from the leather.

(*b*) As the carriage is pulled away from the blade the cam action allows the roller to close against the leather under adjustable spring tension in such a way that the leather is bent downward at right angles over the blade.

(*c*) The carriage action continues until the leather sample has been pulled through the roller-blade combination, thus causing the staking action.

(*d*) At the end of the carriage stroke the cam action opens the roller, and the carriage returns the leather to its original position ready for the next staking stroke.

The sample can be staked any desired number of strokes in any or all directions. For our work we staked 4 strokes from the center of the piece perpendicular to the backbone line of the hide and then turned the piece 180° and again staked 4 strokes away from the center.

This type of uniform staking makes the evaluation of temper differences between a test and its control relatively sensitive, but it should be pointed out that most tanneries try to stake to the proper temper rather than to achieve uniform machine staking. It may be that for laboratory staking our procedure will have to be modified to be more consistent with tannery practice.

After staking, the pieces are air-dried and then evaluated for leather characteristics.

Measurement of area.—Since one of the most important economic factors in leather processing is the area yield, we designed a machine that would accurately and quickly measure the area of the leather samples produced in our laboratory-scale experiments. The machine consists of a 6″ x 6″ area of frosted glass illuminated equally over its surface from below and read from above by a lens and photocell combination. When a leather sample is placed on the glass plate, part of the light to the photocell is blocked off and the photocell has a lower electrical output. The output of this photocell is measured in a bucking circuit against the output of another photocell exposed to the same light. This differential reading is calibrated in terms of the area of the sample.

With this device we can determine the area of our laboratory samples which have assumed a slightly irregular shape during processing although they were originally cut exactly 4″ x 4″. We can measure the area of about 5 samples per minute, which is much more rapid than any planimeter method. We are able to determine the area of a sample with a reproducibility and accuracy of better than 0.2 square inches in approximately 16 square inches. This accuracy is very similar to that obtained on sides and skins on a regular

leather-measuring machine where a precision of 1/4 square foot is usually obtained in leather ranging from 15 to 25 square feet in over-all area.

EXPERIMENTAL

This section deals with the specific procedures followed in studying a given process variable in leather-making and shows in detail the various steps in the method.

Selection of raw stock and preparation of samples.—Since it was necessary to use matched pieces from the same area of the rights and lefts of the same hide, and since no laboratory methods for fleshing small pieces were available, we obtained specially prepared matched sides through the courtesy of the Fred Rueping Leather Company. These sides were prepared in the following manner: Fifty-pound cured hides were selected in the beamhouse, carefully sided down the backbone, and stamped with identifying numbers so that the individual rights and lefts could be picked out later. These sides were given a short drum soak and then green-fleshed, followed by a 24-hour saturated brine soak. They were piled in salt following the brine treatment, wrapped in plastic bags, and sent to the Lehigh laboratory.

The matched sides were placed hair to hair and then stapled together so that the corresponding areas of each side were adjacent, taking care that the front and rear flank pockets were matched. Samples were then die cut (4″ x 4″) over the entire area of the side, and identifying marks were punched into each sample. In order to have enough samples for leather evaluation it was decided to take about 25 pieces for each test and control. This meant that on an average fifty-pound hide about 3 sets of 25 matched samples could be obtained. In order that the samples in each test should represent all areas of the hide, every third set of the matched pieces, counting in rows along the backbone, were placed into one experimental lot. The matched, pieces from one lot were then placed into 2 packs for the test and control alternating rights and lefts in order to rule out any natural difference between the right and left side of the hide. The method of sampling for one experimental lot is best shown in Figure 4. The samples were wrapped in wax paper and stored in the freezer until needed.

Beamhouse procedure and tanning procedures.—The samples were soaked and limed in small (2′ diameter x 1′ wide) drums that could be rotated periodically at slow speed (8 rpm). Drumming periods were automatically controlled by a timer, and for soaking and liming the drum was normally rotated 15 minutes every 2 hours. The drums were large enough so that 2 control sets and 2 test sets could be processed together. This procedure permitted 4 complete experimental sets to be run each week, thus permitting a considerable number of tests to be conducted in a relatively short time.

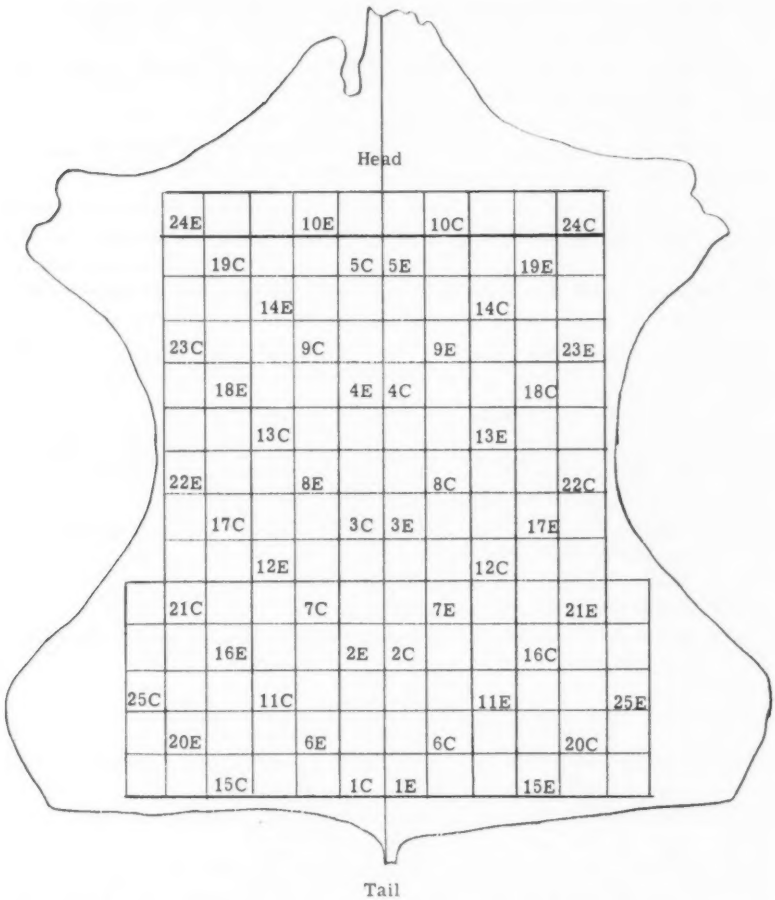

FIGURE 4.—Typical sampling method for 25 matched pairs for experiment and control.

The actual soaking and liming conditions used are shown in the flow sheet. A bate-pickle-tan process similar to that described by Theis and Lotz (6) for tannery testing was scaled down for laboratory use. The exact experimental procedure followed is shown below.

FLOW SHEET FOR LABORATORY TANNAGE

A. Pretannage (25 matched pairs green-salted steerhide, 4″ x 4″ pieces; all percentages based on cured weight)

1. Soak: in drum, 400% float, 24 hours at 70° F., drumming 15 min. every 2 hours.
2. Lime: in drum, 300% float, 10% lime, 1-¾% NaSH, 2 days and 15 minutes drumming every 2 hours.
3. Unhair and scud: by hand with knife.
4. Relime: in drum, 300% float, 10% lime, 1 day and 15 minutes drumming every 2 hours.
5. Wash and acid rinse: Wash about 15 minutes in drum with total of 300% water. Drain. Add 300% float, $^1/_3$% H_2SO_4, drum 15 minutes.

B. Tannage (stock placed in tanning boxes) (all percentages based on white weight)

1. Bate: 100% float at 85° F., 2% $(NH_4)_2SO_4$, 0.1% Oropon N; shake 1 hour.
2. Wash: 0.3 gal/minute at 75° F., 15 minutes; drain.
3. Pickle: 80% float at 75° F. and 7% salt; run 5 minutes. Add 5% by volume H_2SO_4 (33% pure H_2SO_4 by volume); run 1 hour.
4. Tan: Add chrome liquor (2% Cr_2O_3); run 3½ hours.
5. Neutralize: Add dilute NaOH solution in 3 feeds, ½ hour per feed, to achieve desired final pH.
6. Mull: 48 hours (100% humidity cabinet)
7. Press: 500 p.s.i. with one fold of paper.
8. Split: to approximately 4½ oz. on Model A United Shoe Machinery Co. Splitter.

C. Coloring and Fatliquoring (based on blue shaved weight)

1. Retan: 80% float at 74° F. and 4% salt; run 5 minutes. Add chrome solution (1½% Cr_2O_3) and run one hour.
2. Neutralize: Add dilute sodium hydroxide solution in three feeds (15 minutes per feed) to desired pH.
3. Wash: 10 minutes at 75° F. at 0.3 gal. per minute; drain.
4. Neutralize: Add 100% float at 95° F., ¾% borax; run 20 minutes.
5. Wash: 10 minutes at 95° F., 0.3 gal. per minute; drain.
6. Mordant: Add 100% float at 95° F., 2% Quebracho in 20% float; run 25 minutes.
7. Wash: 10 minutes at 115° F., 0.3 gal. per minute; drain.
8. Color: Add 100% float at 115° F. and 1% Solantine Brown R in 20% float; run 45 minutes.
9. Wash: 10 minutes at 115° F. with 0.3 gal. per minute; drain.
10. Fatliquor: 80% float at 115° F.; add 4% Tanoyl B in 20% float; run 30 minutes.
11. Mull: overnight at 100% humidity.

12. Paste: Wring stock twice on washing-machine wringer. Paste on glass plates using Evans "Quick-Stick" paste (120 g. paste to 200 ml. water). Put in drying tunnel overnight (45% relative humidity, 72° F., 800 c.f.m.)
13. Conditioning· Wash paste from samples with brush and water. Put in conditioning chamber for 24 hours (85% R.H.) 73° F.
14. Stake: 4 strokes from each side perpendicular to the backbone on laboratory staker.

Effect of variation in basicity of a sugar-reduced chrome liquor on the properties of leather produced.—These tests are a copy on a laboratory scale of the basicity tests performed by a calfskin tanner on full packs. In principle these tests involve varying the basicity of the chrome liquor during its manufacture by varying the amount of acid added to the dichromate-sugar mixture. The basicity range covered was from about 25% to 55% basic. An attempt was made to bring all tests out to a final neutralization pH of 3.5 regardless of the basicity of the liquor. The exact Lehigh basicities of the liquors used for the tests and controls are shown below:

	Control	Experiment
Test 1	*42.5% basic	27.2% basic
Test 2	42.5% basic	33.2% basic
Test 3	42.5% basic	46.7% basic
Test 4	42.5% basic	55.6% basic

*These are Lehigh or over-all basicity figures and normally run about 5% points lower than the corresponding Schorlemmer values (7).

TABLE I

TANNING DATA FOR BASICITY SERIES

	Test 1		Test 2		Test 3		Test 4	
	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.
Basicity of liquor	42.5	27.2	42.5	33.2	42.5	46.7	42.5	55.6
pH after bate	8.05	8.20	9.30	9.25	9.30	9.35	8.0	8.20
pH after pickle	2.05	2.15	1.95	2.0	1.90	1.95	2.05	2.05
pH after tan	2.75	2.40	2.75	2.50	2.70	2.85	2.75	3.0
pH after neutralization (wanted)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Actual pH neutralization after tan	3.40	3.30	3.40	3.45	3.40	3.40	3.45	3.60
% pure NaOH added on white-weight basis	0.33	0.48	0.38	0.42	0.32	0.25	0.33	0.18
% Cr_2O_3 exhausted after tan	77.0	69.0	65.0	62.0	66.0	67.0	79.0	76.0
pH after retan	3.15	2.85	3.15	2.80	3.05	3.15	3.10	3.35
Actual pH of neutralization after retan	3.50	3.60	3.50	3.45	3.45	3.45	3.55	3.55
pH after fatliquor	3.55	3.50	3.75	3.70	3.70	3.70	3.50	3.50

The data taken during processing are shown in Table I in order to indicate how closely the actual procedure followed the desired process. The results in terms of leather qualities of break, temper, and fullness are shown in Table II for two sorters. This evaluation was done by examining each set of matched pairs and deciding in favor of one piece or the other for a given quality. The sorter had no knowledge of which piece was in the test and which in the control. The area yields in terms of both percentage of initial area and square feet per pound of cured weight are also shown in Table II.

TABLE II

EVALUATION OF LEATHER QUALITIES FROM VARIABLE BASICITY SERIES

	Test 1		Test 2		Test 3		Test 4	
Sorter	42.5* Cont.	27.2* Exp.	42.5* Cont.	33.2* Exp.	42.5* Cont.	46.7* Exp.	42.5* Cont.	55.6* Exp.
A	5	20	13	17	13	15	14	14
Tighter break B	7	18	16	14	11	17	12	16
Total	12†	38†	29	31	24	32	26	30
A	8	17	9	21	13	15	10	18
Firmer temper B	8	17	9	21	13	15	9	19
Total	16	34	18	42	26	30	19	37
A	14	11	9	21	11	17	11	16
More roundness B	14	11	7	23	14	14	11	17
Total	28	22	16	44	25	31	22	33
Area as % of cured area	86.0	88.0	85.0	84.6	78.4	75.7	81.1	79.9
% yield (sq. ft. per lb.)	85.5	86.7	83.5	83.2	75.8	73.5	79.5	77.5

*Basicity.
†Test 1 was reevaluated for break from the standpoint of leatherlike appearance only, and the results were 34 in favor of the control at 42.5% basicity and 16 in favor of the experiment at 27.2% basicity.
Our original evaluation was in terms of tightness only.

In the course of our experimental program we measured the sample areas in the cured, soaked, limed, tanned, and pasted leather conditions. Since this particular experimental series dealt with tanning variables, all the samples were treated exactly alike up to the tanning step, and therefore the area data obtained for all tests through liming could be grouped together for analysis. We found that various portions of the hide (butt, belly, shoulder, back, etc.) showed entirely different changes in area during processing from the cured through the limed state. The general change taking place over the area of the side is best represented in Figure 5 which shows the

soaked, limed, and tanned areas as a percentage of the *initial cured area*. These data are a composite of the results from 4 different hides each of which showed exactly the same trends.

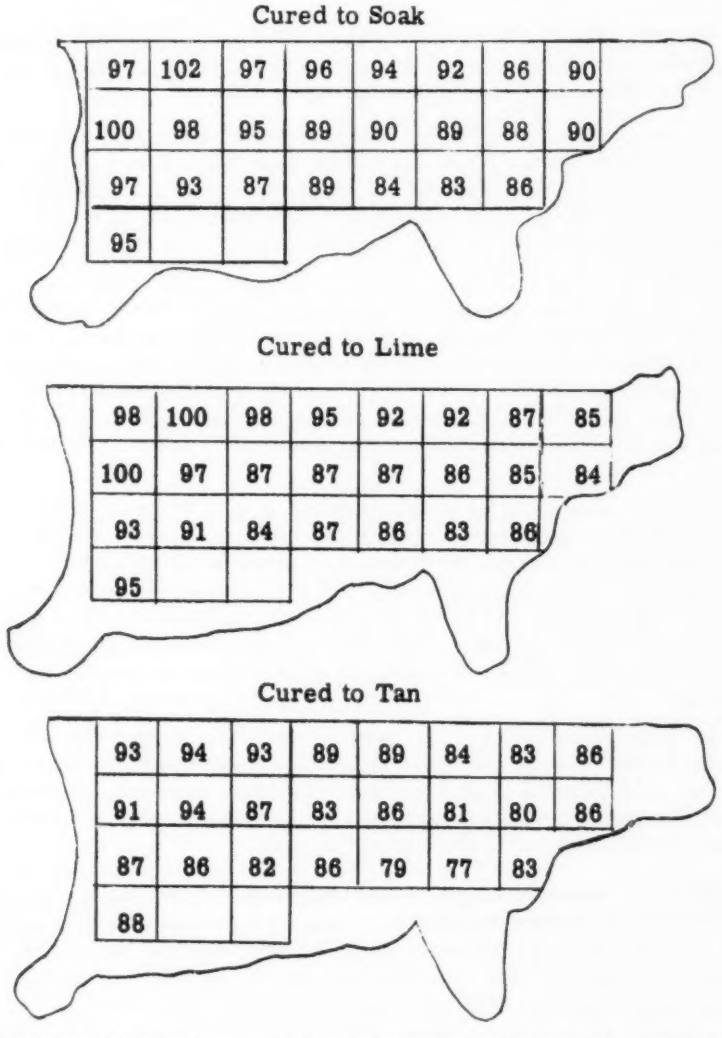

FIGURE 5.—Variation in area of a hide during processing into leather (expressed as % of cured area).

Of course from an economic viewpoint the important area calculation is the over-all area yield in square feet per pound of cured stock, and in the sections dealing with the tanning experiments the areas are reported in these terms.

Results of variable basicity tests.—The results in terms of leather qualities produced by a variation in the basicity of the chrome liquor shown in Table II may be summarized as follows:

(*a*) The lowest basicity (27%) showed a tighter break than the control (42%). However, this break was so tight that it had lost its leather-like appearance, and when evaluated for appearance rather than tightness the control (42%) had a better break than the low basicity (27%) leather. No differences were noted in break between the control (42%) and the other test basicities (33, 47, and 56%).

(*b*) The low basicity liquors (27 and 33%) produced firmer leather than the control (42%). Also the highest basicity (56%) produced a firmer leather than the control (42%). This last result was not anticipated, and an explanation may be that at very high basicity insoluble chrome complexes precipitate in the leather fibers thus producing a firmer temper. No difference was found in temper between the control (42%) and the medium-high basicity (47%).

(*c*) The evaluation of fullness or roundness on 4″ x 4″ pieces of leather is very difficult, and the results obtained in this series of tests indicate that our laboratory evaluation for this quality is not at all satisfactory. For example, the 33% basicity was evaluated as fuller than the control (42%), but no difference could be found between the control and the 27% basicity. We feel that more laboratory work will have to be done on the evaluation of fullness before we can determine the effect of tanning variables on this quality.

(*d*) Area measurements of the pasted leather indicate that the over-all yields are not altered by variations in basicity ranging from 27 to 56%. The actual yield values appear to be lower than those obtained commercially from this weight of hide, and the reason for this is that these samples did not paste properly and had to be rewet and repasted.

Effect of variation in pH of neutralization after tannage on the properties of leather produced.—These tests are a copy on a laboratory scale of the neutralization tests performed by the same calf tannery on full packs. In principle these tests involve varying the pH of neutralization after chrome tanning. The pH range covered was from about 2.5 to 4.0. The basicity of the chrome liquor used was 42.5%. The pH values desired following neutralization are shown below:

	Control pH	Experiment pH
Test 5	3.5	2.5
Test 6	3.5	3.0
Test 7	3.5	3.5
Test 8	3.5	4.0

The exact experimental procedure followed is shown in the flow sheet. The data taken during processing are shown in Table III in order to indicate how closely the actual procedure followed the desired process. The results in terms of leather qualities of break, temper, and fullness are shown in Table IV for two sorters. This evaluation was carried out by examining each set of matched pairs and deciding in favor of one piece or the other for a given quality. The sorter had no knowledge of which piece was in the test and which in the control. The area yields in terms of both % of initial area and square feet per pound of cured weight are also shown in Table IV.

TABLE III

TANNING DATA FOR NEUTRALIZATION SERIES

	Test 1		Test 2		Test 3		Test 4	
	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.	Cont.	Exp.
Basicity of liquor	42.5	42.5	42.5	42.5	42.5	42.5	42.5	42.5
pH after bate	9.25	9.15	9.55	9.40	9.15	9.50	8.95	9.00
pH after pickle	1.95	1.95	1.70	1.70	1.70	1.70	1.70	1.70
pH after tan	2.65	2.60	2.55	2.55	2.50	2.55	2.40	2.40
pH neutralization wanted	3.50	2.50	3.50	3.00	3.50	3.50	3.50	4.00
Actual pH neutralization after tan	3.60	2.35	3.20	2.85	3.20	3.25	3.35	3.65
% pure NaOH added on white-weight basis	0.34	0.55*	0.32	0.14	0.33	0.33	0.33	0.53
% Cr_2O_3 exhausted after tan	75.0	73.0	67.0	67.0	69.0	68.0	70.0	71.0
pH after retan	3.15	2.95	3.25	3.15	3.25	3.25	3.15	3.10
Actual pH neutralization after retan	3.60	2.55	3.65	3.00	3.65	3.65	3.55	3.75
pH after fatliquor	3.85	3.45	3.85	3.45	3.65	3.65	3.85	3.75

*Acid added.

TABLE IV

EVALUATION OF LEATHER QUALITIES FROM pH OF NEUTRALIZATION SERIES

		Test 1		Test 2		Test 3		Test 4	
	Sorter	3.5* Cont.	2.5* Exp.	3.5* Cont.	3.0* Exp.	3.5* Cont.	3.5* Exp.	3.5* Cont.	4.0* Exp.
Tighter break	A	19	9	13	15	13	15	13	13
	B	14	15	16	11	13	15	11	15
	Total	33	24	29	26	26	30	24	28
Firmer temper	A	4	24	7	21	13	15	13	13
	B	3	25	6	22	14	14	9	17
	Total	7	49	13	43	27	29	22	30
More fullness	A	4	24	8	20	12	16	13	13
	B	8	20	13	15	13	15	15	11
	Total	12	44	21	35	25	31	28	24
Area as % of cured area		97.0	98.0	97.8	97.4	100	99.6	95.8	97.0
% yield (sq. ft. per lb.)		93.8	95.5	89.0	88.1	92.3	91.3	90.3	92.0

*pH of Neutralization.

Results of neutralization tests.—The results in terms of leather qualities produced by a variation on the pH of neutralization after tannage shown in Table IV are summarized below:

1. There is an indication that the control (pH 3.5) produced a better break than the lowest pH (2.5). No difference in break could be found between the control (3.5) and the other tests (3.0, 3.5, 4.0). Of course the pH 3.5 test is a dummy test, and no difference was found as was to be expected.

2. A distinct difference in temper was found in this neutralization series. Both low pH tests (2.5 and 3) were definitely firmer than the control (3.5). No difference was found between control (3.5) and the high pH test (4.0). However, it should be noted that the final pH after neutralization in the high pH test was only 3.65 instead of 4 as desired. Perhaps if pH 4 had been obtained, a difference would have been noted.

3. Our evaluation for fullness indicated that both low pH tests (2.5 and 3) produced fuller leather than the control (3.5). However it should be noted that we have called the firmer leather fuller in each case, and we think that probably we have confused fullness with temper. We hope that with further work on this quality of leather we can develop some method whereby fullness can be adequately evaluated in the laboratory.

4. The areas reported indicate that a variation in pH of neutralization from pH 2.5 to pH 3.6 has no effect on the over-all yield of leather. Here the actual values of the yields are much closer to commercial experience with this weight of hide than the values reported in the basicity variation series. In this series of tests we had no trouble with the pasting, and we feel this is the primary reason for the closer agreement.

General conclusions of laboratory results and comparison with tannery data.—In order to see whether the laboratory production and evaluation of leather gives the same results as tannery-scale tests, the results in the two series of experiments must be compared with the results obtained at the calfskin tannery for these same tests.

BASICITY VARIATION SERIES

	Calfskin Tannery	Lehigh Laboratory
Break	30% basic, poorer than others; all others, no noticeable difference.	27% basic, very tight but poor appearance compared to control; all others, no noticeable difference.
Temper	30% basic, firmer than all others; 35 and 40%, firmer than 45 and 50%.	27 and 33% basic, firmer than 42%, 42 and 46%, no difference; 56%, firmer than 42%.
Fullness	30% basic, poorer than others; 35% basic, poorer than all higher; others, no noticeable difference.	33% basic, fuller than 42%; others, no noticeable difference.

pH OF NEUTRALIZATION SERIES

	Calfskin Tannery	Lehigh Laboratory
Break	pH 3.3, better than all others; others show no noticeable difference.	pH 3.6, better than pH 2.4. All others, no noticeable difference.
Temper	pH 2.9, firmer than all others; pH 3.76, softer than 3.56; others, no noticeable difference.	pH 2.4, firmer than 3.6; pH 2.8, firmer than 3.2; others, no noticeable difference.
Fullness	No noticeable difference in any tests. Small indications of increase in fullness with increase in pH.	pH 2.4, fuller than 3.6; pH 2.8, fuller than 3.2; no difference in others.

From the general conclusions we can see that the laboratory test method both for the production of leather and its subsequent evaluation has been shown to be highly comparable to tannery tests as far as break and temper are concerned. The laboratory technique for the evaluation of fullness is not good, and more work on this problem must be carried out.

The over-all results of the two series of tests in general terms may be summarized as follows. These results of course apply to a nonmasked tannage and to full chrome, lightly mordanted, fatliquored, smooth dress leather.

1. A low basicity chrome liquor (30%) tends to produce a firm leather with too tight a break. Increase in basicity leads to softer leather and better appearing break with an improvement in fullness. Very high basicities (55%) *may* lead to firmer leather than medium basicities (40–50%).

2. A low pH of neutralization (2.5) produces a poorer break and a firmer leather than higher pH's. The leather becomes softer as the pH is raised, but the break eventually (pH 3.8) becomes loose. Fullness is not much affected by pH of neutralization.

GENERAL CONCLUSIONS

The laboratory testing method both for the production of leather and its subsequent evaluation has been shown to be highly comparable to tannery tests as far as break and temper are concerned. The laboratory technique for the evaluation for fullness is not good; more work on this problem should be carried out.

Since the proof of the laboratory method is based on only two variables of tanning, further work should be carried out, testing many different types of variables, in order to see if the results also correlate with full-production packs of leather. Through the use of this laboratory method many different variables can be tested and evaluated in a short period of time. It is hoped that, after compiling all this data, it will be possible in the future to plan experiments using a factorial design so that a study of the interactions of these variables may also be made.

ACKNOWLEDGMENT

The authors would like to express their appreciation to the group of chrome-producing companies who encouraged and supported this work—American Cyanamid Company, Diamond Alkali Company, Mutual Chemical Company, and in its later stages the Columbia Southern Chemical Company. They would also like to thank the Ohio Leather Company and the Fred Rueping Leather Company for their cooperation in various parts of the project.

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DISCUSSION

MR. J. T. CHAIN (Diamond Alkali Company): Dr. Stubbings, I think everybody in the leather industry, especially the leather chemists, owes you quite a vote of thanks. I have been in this business for quite a few years, and it has been a long, hard fight to get anybody in the tannery to have any particular interest in what came out of the laboratory.

Perhaps they were right. Most of the things we did in the laboratory would not check when we got them out in the tannery. But I think we are getting closer all the time to where laboratory work checks with production. When we can do that, I think the prestige which has been somewhat lacking for the average leather chemist is going to rise tremendously, to where the plant superintendent and management will be extremely interested in what comes out of the laboratory.

I would like to ask Dr. Stubbings what effect there would be on the number of samples if we used side leather, or sheepskin, or goatskin, compared with calfskin?

DR. STUBBINGS: We have used calf and side leathers. Of course with side it becomes a difficult job for most laboratories to obtain stock, because you have to have the whole skin. In this type of test, as far as we can tell, the number of samples needed is relatively the same for the two.

We have not done goatskin work, but just as a guess I would say that the number of samples needed would be of the same order of magnitude.

MR. CHAIN: Just as a check on the findings between Lehigh and Ohio Leather Company and J. R. Evans Company—in one example they show that with increased basicity increased softness is obtained. Are there any of you people here who would agree that that is what you would expect in your tannery? The value of what Dr. Stubbings is doing here is only realized if it holds true for everybody. Would anybody like to comment on that?

DR. LUDWIG SELIGSBERGER: I would like to ask how many samples could be put in at one time and how much the results depend on the number of samples.

DR. STUBBINGS: Actually the equipment will handle a maximum of 30 to 35 samples of cowhide (4" x 4"). The only reason for not taking fewer samples, although the equipment will handle them perfectly well, is that when you are finished you cannot evaluate the results unless you have enough samples. In other words, if you take only six samples each, you cannot get results in terms of evaluation, not in terms of tanning the leather. You must take about 20 or more. I would say that any change in design would have to be toward the higher side and not toward the lower side, although the equipment will handle as few as a half-dozen samples.

MR. CHAIN: I would like to ask one more question: What part of the skin shows the greatest changes as a result of the different chemical applications?

DR. STUBBINGS: Of course this depends a lot on the type of variable you are studying. But this is an observation I am making now offhand, based on about 10 general runs of this type through the machine. I would say that in the butt areas it is very difficult to make measurements of differences in break, because, regardless of the experimental variable, samples in the butt area tend to have pretty much a similar break, and it is usually good break, of course. We usually see the major differences in break in the belly and flank areas. I think it is more difficult to see the differences in temper using samples from the belly areas than from the butt areas. The bellies are generally softer, and it is much more difficult to split the two pieces equally for the final leather.

We do not, however, attempt to decide where the sample is from when we do the evaluation. We have the samples paired off and stapled together so that a butt and a butt or a belly and a belly are the only two we are comparing at any one time. We simply evaluate between those two little pieces. But in the over-all effect, I would say that a difference in break is more discernible in the flank and belly areas and that temper is much more readily ascertained in the butt areas.

DR. THOMAS C. THORSTENSEN (Dept. of Leather Engineering, Lowell Technological Institute): I wonder if you would elaborate a bit on how you went about the evaluation of break, temper, and so forth, on your laboratory samples?

DR. STUBBINGS: We take all the samples paired. For this particular illustration we have 25 paired samples. We give them to someone to evaluate, someone who supposedly knows how to evaluate a quality like break. We ask him to tell us from each pair of samples that he gets, which has the tighter break or the better break. Now, as you can see in Test 1, comparing 42.5% basic liquor against the 27.2% basic, which is the experiment in this case, sorter "A" found that 18 of the pairs were better in the control and 7 better in the experiment, while sorter "B" found 16 of the pairs were better

in the control and 9 in the experiment, roughly the same finding as sorter "A." Neither sorter, at the time he did the sorting, knew which member of the pair was from experiment or control. He simply called one of them better than the other. Later on the data were all sorted out into experiment and control.

Of course it would be much simpler to evaluate some chemical variable or a physical test variable, because a standard variance analysis can be done. But for this type of subjective evaluation this is the only technique that we have found that we can in anyway rely upon.

The annual convocation of the Bengal Tanning Institute was held April 27, 1957, at the Institute with Mr. B. C. Mallik, Director of Industries of West Bengal, presiding. Dr. D. Chakraborty, Registrar, Calcutta University, delivered the convocation address. Certificates from Calcutta University, as well as Departmental Certificates from the Directorate of Industries, were awarded to graduates in Tanning and in Boot, Shoe and Leather Goods Manufacture. In his convocation address Dr. Chakraborty pointed out the importance of the Indian tanning and leather industry and its need for further development. He also expressed the hope that the students awarded the certificates would work wholeheartedly for the betterment of the industry. As Calcutta University felt the need of upgrading its technical education in tanning, it affiliated with the Bengal Tanning Institute in 1955 for the B.Sc. (Tech.) Degree in Tanning; therefore, future graduates in tanning, Dr. Chakraborty said, would be better trained and better able to serve industry and country. After the address medals were awarded to the most successful candidates of the year in different courses. With a vote of thanks proposed by Sri M. Banerjee, Superintendent of the Institute, the convocation terminated.

The following day the annual reunion and social gathering was held with Mr. M. L. Khaitan, Chairman, Board of Directors, Bata Shoe Co. Ltd., presiding and Mr. Hemendra Prasad Ghose, the eminent journalist, as main guest. Arrangements for the reunion were in charge of a committee headed by Mr. P. K. Sarkar.

In the early eighties the first recorded instance of any real attempt to launch a glovers trade union occurred at Worcester (England). There the Glovers' Trade Society was formed in 1884.

—*Gloves and the Glove Trade*. B. Eldred Ellis. London: Sir Isaac Pitman & Sons, Ltd., 1921.

In the early days of the glove industry, leather gloves were almost always made of either deer skin (buck skin) or sheep skin. Nowadays, however, gloves are made from a wide variety of skins. Those chiefly used are kid, goat, sheep, lamb, reindeer, antelope, gazelle, calf and colt. Kid and goat skins, and lamb and sheep skins supply the greatest part of the leathers used for gloving, whilst reindeer, antelope and gazelle are used largely —when available. We mention calf and colt, for although they are rarely used to-day for glove-making they were employed formerly to a limited extent. Colt skins are still used in America for workmen's gloves.

—*Gloves and the Glove Trade*. B. Eldred Ellis. London: Sir Isaac Pitman & Sons, Ltd., 1921.

A SWEDISH PIONEER OF TANNING TECHNOLOGY IN THE BERZELIAN ERA*

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We make our living on some of the most complicated chemical reactions known to man, those forming the basis for the tanning processes, a field of great fascination to the imaginative chemist and investigator, also exigent to the experimentalist. The solid substrate, a sow's ear to be made into a silk purse literally, is the protein of hide, the collagen, which is the etymological father of colloids.

In spite of the great efforts of the scientific investigator, our knowledge of the proteins, vital to life and its carrier, was deplorably meager until very recently. The development of new, handy, inexpensive, rapid and accurate methods of analysis and separation of the amino acids, the building stones of the proteins, which is a revolution brought about in the last decade or so, has also made the collagen less abstract; even the spiral forms of its polypeptide chains being a familiar picture and a measure of the progress in protein chemistry.

Even though problems which some ten years ago were considered to be outside the domains of experimental chemistry are now within its reach, and solved, or partly so, such as the problem of the order in which the amino acid residues are arranged in the protein molecule, in insulin for instance, there are numerous issues of dominating importance still riddling the scientist, for instance, the steric conditions in the collagen structure. Regarding the other component of the tanning system, the tanning agent, great progress has been made in elucidating the various tanning agents, particularly the two most important practically, the basic chromium salts and the vegetable tannins.

Turning the clock back some odd 150 years, we will find the two leading chemists of that era, Berzelius in this City (Stockholm), and Davy at the Royal Institute in London ascribing to the motto of Linneus that one of the main goals of scientific inquiry should be the furthering and advance of agriculture and handicrafts, the national economic aspects of Science. Their interest included the nature of tanning, and the mechanism of tanning processes. Davy's contributions to the knowledge of the vegetable tannage by investigating the composition of the glue-tannic acid precipitates are well-

*Presidential Address, delivered at the Fourth Biennial Conference of the International Union of Leather Chemists' Societies, Stockholm, Sweden, August 1-5, 1955. Reprinted by permission of the author from *Ladertidningen*.

known. Also Berzelius' interesting research on the nature of the reaction of glue and collagen with aluminum salts, alum, is one of the earliest, if not the earliest, studies of the mineral tannage. The Linnean tradition had earlier been upheld and documented by the Swedish apothecary, Carl Wilhelm Scheele, who discovered and studied a number of organic compounds of interest in tanning, such as oxalic and lactic acids, and above all gallic and tannic acids.

In these early years, a searching mind in chemistry had to be one out of two things for facilities of chemical experimentation: either a professor of Medicine, like Berzelius, or an apothecary or chemist (or druggist) as Scheele. Carl Hyltén-Cavallius, also known as Cavallin, whose life and work is the subject of my lecture was also a druggist, being born 31 years after Scheele's death, or in 1817.

The name Cavallin is familiar to most of us from the early history of the chrome tanning process. In the outstanding treatise on chemical technology of its day, Muspratt's Chemistry, it is stated in the early 1860 edition that chrome salts were first used for tanning by Cavallin; a statement often repeated in later books on chrome tanning, none however, giving the source of information or literature reference.

Before discussing Cavallin's contributions, some milestones in his life will be recapitulated. He belonged to a well-known family of soldiers and scholars. His father was the minister for the parish in Wislanda in the county of Smolandia. By the way, the Smolanders are somewhat of Swedish Scotsmen, thrifty and industrious people. However, our man was not a thrifty Smolander, rather an exception proving the rule, since he appears to have had an artist's temperament;—his main weakness being not to be able to handle money, probably because of his intellectual exercises being his all-absorbing interest. As mentioned already, he came to this world in 1817, finished his secondary school in Växjö in 1832, continued his studies in Uppsala, where he matriculated and obtained his apothecary degree (license) in 1838. After running a chemist shop in Uppsala the following two years, he became an instructor in chemistry at the Royal Institute of Technology for 4 years, leaving in 1844 when he bought a chemist shop in Kungälv, a small town outside Gothenburg. From his correspondence with his father, it is known that he experimented with his chrome tanning process in his own tannery in Kungälv, "rather small but the most modern one in this town" as he writes.

After a few years he returned to chemistry, receiving a teaching appointment in chemistry and chemical technology at the Chalmer's Technical Handicraft School in Gothenburg. During these years he apparently did not do much experimenting, his spare time being devoted to writing a text book on chemistry. From his teaching years in the fifties, the records of his school mention his name in connection with his frequent demands for raises in salary. Evidently, he had certain difficulties in making both ends meet,

having married in 1847 and three children coming along. Death came to him in a manner not uncommon in these days, prior to the antiseptic era. On shaving he cut a pimple on his chin, blood poison set in and his life could not be saved. His life span was short, 36 years, and his active work as an independent investigator lasted 3 years only, or the time of his association with the Royal Institute of Technology in Stockholm, where the chrome tanning experiments were carried out mainly during 1841—1842.

Turning to his contributions to chemistry, it is evident that his main interest was in research and experimentation. He had an inventive mind, being less of a theorist, or deep-loading scientist, which was a draw-back in his attempt to have his papers published in academical journals. The comments on his papers by the refereee of the Royal Swedish Academy of Science, given in the 1844 Proceedings, to which they were submitted for publication, are the only records on hand of all the papers except two, and the patents. It should be remembered that Berzelius was then the allmighty permanent Secretary of the Royal Academy. He was as careful as an Editor as he was as a Chemist.

Before accepting papers for publication, he or his assistants repeated all or part of the experiments reported in the papers. Berzelius' right hand man, Professor Mosander, was instructed to do so with Cavallin's papers. Mosander was an outstanding mineralogist and inorganic chemist, having to his credit the discovery of four elements of the two dozen or more discovered by the Swedish chemists. Unfortunately for Cavallin, this exacting inorganic chemist showed little appreciation of the type of work contained in Cavallin's papers. Moreover, his control experiments did not check the results reported by Cavallin. Consequently, the papers were rejected. The experimental disagreement concerned mainly two non-protein papers, one on dissolving rubber for adhesive, the other an analytical test for indigo. The third paper was a study of the reactions of glue with acids, alkalis and various salts, including heavy metal salts, also chromic acid. Further, the effect of neutral salts of alkali metals on acidified glue (HCl) had been investigated. This is the most valuable part of this paper and probably the first experimental contribution on the pickling process in tanning. There was no serious disagreement on the experimental points. However, since only the description of the results without any data were given and no explanation of the phenomena was attempted, the paper was not considered to meet the requirements for the publications of the Royal Swedish Academy.

In the fourth paper, commented on by Mosander in the 1844 Proceedings, a new method for making high-grade glue is described in some detail. It was also rejected by the Academy, since Mosander was not able to duplicate Cavallin's results and his claim of making a glue superior to the ordinary type. It was published later by Cavallin in 1850 during his Gothenburg period. It is an exceedingly interesting paper, because it means an entirely

new approach to an old problem. By treating the glue stock, hide trimmings, for a very brief period (some few minutes) in a concentrated solution of common salt, sodium chloride, brought to the boil, he reports the shrunk collagen to be easily made into glue or gelatin by a subsequent short treatment in saturated lime solution. The glue thus produced was claimed by Cavallin to be brighter and less soluble in water, to possess better adhesive power, and to give greater yields than ordinary glue. Moreover, the time of liming before the "boil-off" was cut down from several months to a few days' time. As already mentioned, these claims were not upheld by Mosander's results in his control experiments.

It is interesting to note that in Cavallin's method the lyotropic, or specific neutral salt effect of the chlorides in concentrated solution and the heat-denaturation are combined, both having the same tendency to break certain interchain bonds in collagen preparatory to its conversion into glue. These principles have recently been advanced as an innovation in glue-making by Küntzel and Koepff (1938).

At the time of Cavallin's investigations in the early 1840's, the main mineral tanning agent used was aluminum sulfate in the form of alum, which has a feeble tanning effect only. Also ferric salts had been experimented with earlier, but they had never attained practical importance. From his series of tests as to the effect of heavy metal salts, including aluminum, ferric and chromium salts on glue, Cavallin conceived the idea of chrome tanning.

The results of his experimentation are laid down in Swedish Patent Nr. 1530, granted to him in April 1850. Hyltén-Cavallius stresses the fact that the new method differs from the conventional processes of tanning in so far as no bark or other substances containing tannic acid is required; the tanning being effected by "chemical salts" such as bichromate of potassium after the hides have been struck through by a solution of "minerals". He points to the speed of the process and stresses that his method will not lead to an "ultimate devastation of the oak forests". Various modes of tanning are exemplified, *e.g.*, tanning with chromium salts entirely, pre-tanning with alum and chromium salts or with alum and ferrous sulfate (copperas). In the latter instance, the pretannage is followed up by a bichromate bath. Also combinations with vegetable tannins are mentioned, *e. g.* vegetable-mineral tannages in combination.

The following example is mentioned, being the method cited in the literature generally. Alum is used as the source of the sulfuric acid required to set free the chromic acid from the potassium bichromate, and further ferrous sulfate, copperas, the most common and the cheapest reducing agent at that time, is used to reduce the hexavalent chromium fixed by the skin collagen to the trivalent state. At the same time ferric iron is produced and fixed by the hide in the second bath. All these changes involve the transference of compounds of a valency state in which they are inert to collagen into com-

pounds of a valency state in which they possess a marked affinity for the hide protein. Undoubtedly, the method is ingenious as far as its chemistry is concerned.

Cavallin's method was in principle: The delimed pelt was kneaded for four days in a solution of 10 kg. potassium bichromate, and 20 kg. alum, in 180 liters of water. The skin collagen combined with the chromic acid set free by the acid from the protolyzed solution of aluminum sulfate which was turned into basic sulfate with improved tanning power. The chromated pelt was then brought into a 10 per cent solution of ferrous sulfate, and left there for one day. The fixation of basic chromium and ferric sulfates takes place, changing the original, weakly greenish solution into a dark-brown liquid. Gradually the leather takes on that colour also, while a greenish tint of the residual solution is developed. As to the quality of the leather produced, Cavallin claimed it to be fully as good as the ordinary vegetable tanned leather. A tanner in Stockholm tried his method and Cavallin claims that the leather was superior to the leather then available. During the last two years of his life, Cavallin tried to interest some English tanners in his method. Nothing definite is known about the results of these negotiations. His important contribution is a landmark in the history of the mineral tannage, being a well-balanced combination of three mineral tanning agents.

Some pieces of leather have recently been made, closely following the original procedure, as far as the tannage is concerned. At the time of Cavallin's work and for the four following decades, a serious obstacle to the success of the chrome tannage was the lack of a suitable method of incorporating grease and oil with the leather, and also the lack of finishing methods. These difficulties were first overcome by the practical pioneers in chrome tanning in USA during the late 1880's.

The main findings were as follows. The pelt removed about 40 per cent of the bichromate given. Correcting for the chromium present in the solution and mechanically held by the chromated pelt, the amount of chromium combined with collagen was 5.6 percent as Cr_2O_3, on the basis of collagen. The final pH value of the first bath was high, or pH 4.1. As to the reducing bath, its equilibrium pH was 2.9. The leather after having been washed free from uncombined matter contained, on the dry weight basis: 4.1% Cr_2O_3, 18.9% Fe_2O_3, 8.6% SO_4, and 73% collagen. Hence, the amounts of Cr_2O_3 and Fe_2O_3 irreversibly fixed by the collagen were 5.6 and 25.9 per cent, respectively. The Ts of the leather was 80—82°C. A Ts increase of 18—20° was thus obtained by the tanning. The leather could be air-dried in the non-fatliquored state without getting bone-hard, as chrome leather does. The dried leather could be wetted back readily to a soft, pliable piece of leather; quite the contrary to straight chrome leather. It is known from the clarifying research of Otto that the common ferric salts, under conditions as those prevailing in this tannage, exist in solution as non-cationic complexes mainly,

combining with collagen as polyacids. Cavallin's leather is more of a polyacid leather than a chrome leather, the large amounts of iron compounds combined with the collagen giving it its character, almost indistinguishable from common vegetable tanned leather as to its great fullness and feel on handling.

I am indebted to Mr. Olof Hyltén-Cavallius, the Pioneer's grandson and to Mr. S. Hemberg for their valued help in collecting information. Mr. Hemberg once voiced his opinion, which I most heartily second, on the outstanding trait of Carl Hyltén-Cavallius' life and work. His greatest credit is the fact that he, a man secluded in the laboratory, took interest in common things, even in such evil-smelling substances as hide offal and glue, at a time when there was plenty of simple inorganic compounds and sweet-scented organics to be investigated.

By his searching and experimentation, he has erected for himself a lasting memorial.

Anybody who has anything to do with research knows very well that a hunch may be the real reason for conducting an experiment. And that often an experiment may change so radically after it has begun . . . that it really becomes a different experiment entirely. But you'd never think so when you read the published scientific report describing it.

The scientist you know as a genial, sensible, rather humble man, often becomes pompous and formal when he puts pen to paper. You'll probably never read a paper that begins "For no good reason at all I had a hunch that . . ." or, "I was just fooling around one day when. . . ." No sir! All trace of anything haphazard, anything human is removed from published reports. The paper will more likely begin: "In view of recent evidence concerning the validity of the Glockenspiel theory, it seemed advisable to conduct. . . ." And the report goes on to describe a carefully thought out experiment that inevitably followed not only a logical, but also a chronological order. This was done, then this resulted; therefore, these conclusions were suggested. . . .

So if the scientist promulgates the fallacy that all experiments follow a definite chronological order, perhaps management can be forgiven for setting up unrealistic time tables. —W. Furness Thompson, Vice President, Research and Development Division, Smith, Kline & French Laboratories, before the National Industrial Research Conference in Chicago, as reported in *Chemical Engineering News*, **35**, No. 22, 30 (1957)

A curious sidelight is thrown upon the importance with which the glove was regarded by the gentlemen of fashion in the early nineteenth century, by the following rules which, it is said, were laid down by the famous Count d'Orsay: "An English gentleman," he said, "ought to use six pairs of gloves a day. In the morning to drive a britzska to the hunt, gloves of reindeer. At the hunt, to follow a fox, gloves of shammy leather. To return to London in a Tilbury, after a drive at Richmond in the morning, gloves of beaver. To go later for a walk in Hyde Park, or to conduct a lady to pay her visits, coloured kid gloves, braided. To go to a dinner party, yellow dog's-skin gloves. And in the event, for a ball or rout, gloves of white lamb-skin, embroidered with silk."

—*Gloves and the Glove Trade*. B. Eldred Ellis. London: Sir Isaac Pitman & Sons, Ltd., 1921.

LIFE LINES

Brief Biographies of Our Contributors

Dr. K. H. Gustavson is too well known to require an extended biographical note. He is universally recognized as one of the foremost leather chemists of our time. His chief interest is chrome tanning, but he has made numerous and important contributions to nearly every stage of leather manufacture. "Gus" spent some ten years in this country, in the 1920's and early 1930's, during which period he was an active member of ALCA and a copious contributor to this *Journal*. He returned to Sweden in the mid-30's and is now Director of the Tanning Research Institute in Stockholm.

Herbert Jack Hodus, recipient of the Winheim Award at the Fifty-third Annual Meeting, received his B.S. in Leather Engineering from Lowell Technological Institute in 1954 and his M.S. in Chemistry from Lehigh University in 1956. During his two years at Lehigh he held a research fellowship in the Leather Research Institute. His work there on laboratory tanning procedures and equipment under the direction of Dr. Robert Stubbings has resulted in the two papers being published in this issue of the *Journal*. Mr. Hodus is now engaged in research and development work with the Ohio Leather Company.

Dr. Robert Stubbings—See the October, 1956, *Journal*.

The treatment of animal skins to fit them for useful purposes is a practice which seems to exist wherever mankind has been found. In China the manufacture and use of leather dates back to the remotest eras of its very ancient history, in the more recently discovered continents of America and Australia the curing of skins was found to be well known and widely practised, and even in the most ancient of the Western civilizations the preparation of some kind of leather seems always to have had a place in human skill and knowledge. The Egyptians, who formed the first civilized nation of history, have left considerable evidence, both as relics and drawings, of their very early acquaintance with the dressing of skins, including vegetable tannage, the dyeing, painting, gilding, and embossing of lighter leathers, and the manufacture of shoes, straps, aprons, and other useful articles from the leathers so prepared . . . . Pliny mentions that gall-nuts, bark, and sumac were used as tanning materials.

—*The Manufacture of Leather*. Hugh Garner Bennett. New York: D. Van Nostrand Company, 1910.

ALCA NEWS

Proceedings, Reports, Notices, and News

of the

AMERICAN LEATHER CHEMISTS ASSOCIATION

OFFICERS

President—E. B. Thorstensen, S. B. Foot Tanning Company, Red Wing, Minnesota

President-Elect—Mieth Maeser, United Shoe Machinery Corporation, Research Division, Beverly, Massachusetts

Secretary-Treasurer—Fred O'Flaherty, Department of Leather Research, University of Cincinnati, Cincinnati 21, Ohio

Council

E. D. Compton, Eagle-Ottawa Leather Company, Grand Haven, Michigan

Robert Stubbings, Division of Leather Technology, Lehigh University, Bethlehem, Pennsylvania

E. Daniel Lord, J. S. Barnet and Sons, Lynn, Massachusetts

Robert G. Weldon, Seton Leather Company, Newark 4, New Jersey

Frank Zeissig, International Products Corporation, Staten Island, New York

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G. A. Kerr, W. H. Teas, H. C. Reed, J. H. Yocum, F. H. Small, H. T. Wilson, J. H. Russell, F. P. Vetch, W. K. Alsop, L. E. Levi, C. R. Oberfell, R. W. Griffith, C. C. Smoot, III, J. S. Rogers, Lloyd Balderston, J. A. Wilson, R. W. Frey, G. D. McLaughlin, Fred O'Flaherty, A. C. Orthmann, H. B. Merrill, V. J. Mlejnek, J. H. Highberger, Dean Williams, T. F. Oberlander, A. H. Winheim, R. M. Koppenhoefer, H. G. Turley, E. S. Flinn

NOTICE TO AUTHORS AND ABSTRACTERS

The Editor-in-Chief expects to be out of the United States from about August 9 to October 10, 1957.

From July 15 to October 1 all manuscripts, copy for abstracts, and anything else for the Editor-in-Chief's attention should be mailed to

Dr. T. C. Thorstensen
Associate Editor
Research Foundation
Lowell Technological Institute
Lowell, Massachusetts

A MESSAGE FROM THE PRESIDENT*

Welcome to this, our Fifty-third Annual Meeting. Many things have happened since our good meeting at Mackinac last year. As president, I am happy to summarize for you the activities of our Association since that time and to give you a brief account of our stewardship.

This year's convention is under the chairmanship of Clint Retzch. The committee started work immediately following the meeting at Mackinac. It is becoming increasingly difficult to find resort hotels with facilities to meet all the needs of our organization, and we commend our convention committees—both this year and in previous years—for doing an outstanding job.

Our present membership is 1077, made up of 927 active and associate members and 150 mutual members. 101 new members joined us. 33 resigned for various reasons. Death has taken 9 of our associates during the past year: William Z. Beier, August Boss, Louie Erera, Ellis B. Miller, Dr. Joseph Caspe, Dr. William Cox, Raoul Berger, Paul Schutte, and James Mahle. We revere their memory.

New ideas for our *Journal* have been taking shape under the editorship of Dr. Merrill and Mr. Watt. Our "new look" seems to be universally approved. To cover the higher cost of printing, it was necessary to increase advertising rates by 15%. This resulted in the temporary loss of some copy, but we believe our present campaign for more advertisers will not only replace this loss but also bring in sufficient additional revenue to take care of the printing costs and the employment of a managing editor. The continuance of competent editing has been assured by the appointment, without compensation, of Dr. T. C. Thorstensen as associate editor. The arrangement with Lowell, which Dr. Flinn mentioned last year as being on a probationary basis, is being continued.

A full report of our financial situation was made under date of March 2. Our treasury is in a healthy condition in spite of the drop in revenues from *Journal* advertising. The increased cost of producing the *Journal* and the allocation of $2000 to the Rome meeting have reduced our surplus only $493.24, or about 0.8%.

$1000 has been awarded to Dr. Rubin Borasky as the winner of the prize paper presentation. Papers entered in the competition were judged by a committee appointed by the Council.

The Council also appropriated $1000 to partially defray the expense of a

*Introductory address presented by ALCA President E. B. Thorstensen at the Fifty-third Annual Meeting, June 2-5.

delegate to the International Conference in Rome. We are entitled to seven representatives at this conference. As of now, six representatives have been named: Dr. Henry Merrill, Dr. Harold Turley, Dr. Fred O'Flaherty, Dr. Rubin Borasky, Dominic Meo, and myself. I would be happy to know of anyone else who plans to attend the Rome meeting so that I may appoint our seventh official representative.

Our technical committees are functioning under the able direction of President-Elect Mieth Maeser. If you have been reading your *Journal*, you know that the joint ALCA-ASTM committee is making progress.

Oscar Wederbrand, our chairman of ways and means, is to be commended for a job well done.

Last fall our Association was represented at the Perkins Centennial in New York by a panel headed by Dr. Ell Dee Compton. Papers were presented by Joe Casnocha, Bob Stubbings, C. H. Geister, and Stanley Kirk.

We have tried to keep you fully informed of the activities of the Association through the fine reporting of our secretary, Dr. O'Flaherty, and the excellent editing and expediting of our editor, Dr. Henry Merrill.

The individual members of your Council have all been very alert to their responsibilities and have been eager to be of service. They deserve your thanks and mine.

While we have not included a symposium in our program for this meeting, I am sure you will find much food for thought in the many and varied papers being presented. We invite your entering into discussion on any paper that may strike your particular interest. It is our sincere hope that the committee for 1958, in cooperation with the various production clubs, will start to work at once to organize a first-rate symposium for Swampscott.

Criticisms of any Association activities or suggestions which will yield constructive benefit are always most welcome. You may address these to our secretary, to our editor, or to me, and they will be given prompt attention.

As your president and on behalf of the leather industry I have tried to carry out the objects of the Association to the best of my ability and have been particularly active in promoting sponsored research. This called for considerable travel and time, but the enthusiastic support given by so many members has made it all very gratifying.

I offer my sincere personal appreciation to the officers, the Council members, and all the committees functioning on behalf of the American Leather Chemists Association. Working with them and serving as your president have made the past year a singularly rewarding one for me. I thank you.

FIFTY-THIRD ANNUAL MEETING

Lake Placid Club, New York

GENERAL PROGRAM

Sunday, June 2

Technical Committee Meetings

Mineral Leathers—R. ADAMS, *Ch.*	2:00 P.M.
Physical and Mechanical Properties—ELL DEE COMPTON, *Ch.*	2:00 P.M.
Standards and Specifications—C. G. TELANDER, *Ch.*	2:00 P.M.
Vegetable Leathers—A. KAY, *Ch.*	3:00 P.M.
Leather Finishes—B. ROLL, *Ch.*	3:00 P.M.
Mechanical Leathers—H. KRAKOWSKI, *Ch.*	3:00 P.M.
Tannery Waste Disposal—J. F. WAGONER, *Ch.*	3:00 P.M.
Evaluation of Raw Stock—T. C. THORSTENSEN, *Ch.*	8:15 P.M.
Preparatory Tanning Operations—WILLIAM T. RODDY, *Ch.*	8:15 P.M.
President's Reception	6:00 P.M.
Lake Placid Movie	9:00 P.M.
Dancing	10:00 P.M.

Monday, June 3

Technical Session—E. B. THORSTENSEN, *Presiding*	9:00 A.M.–NOON
Golf Tournament	1:15 P.M.
Dinner	6:30 P.M.
Entertainment and Dancing	8:30 P.M.

Tuesday, June 4

Technical Session—M. MAESER, *Presiding*	9:00 A.M.–NOON
Journal Editorial Board Meeting	NOON
Technical Session—R. STUBBINGS, *Presiding*	2:00–5:00 P.M.
Annual Banquet	7:30 P.M.

Wednesday, June 5

Technical Session—F. O'FLAHERTY, *Presiding*	9:00 A.M.–NOON
Council Meeting	2:30 P.M.

TECHNICAL SESSIONS

Monday, June 3

E. B. THORSTENSEN, *Presiding*

9:00 a.m.—President's Message
E. B. THORSTENSEN, *S. B. Foot Tanning Company*

9:30 a.m.—The Analysis of Cured Hides for Leather Making Substance
BY R. M. LOLLAR, *Tanners' Council Laboratory, University of Cincinnati.*

10:00 a.m.—Ionic Species in Chromium Sulfate Solutions
BY RALPH R. MARLATT, *Diamond Alkali Company*

10:30 a.m.—The Use of the Leuco Ester Vat and Azioc Dyestuffs in the Coloring of Leather
BY J. S. KIRK, *General Dyestuff Company*

11:00 a.m.—Some Economic Aspects of Grub Control
BY F. O'FLAHERTY, *Tanners' Council Laboratory*

Tuesday Morning, June 4

M. MAESER, *Presiding*

9:00 a.m.—The Preparation and Tanning Properties of Phenolic Derivatives of Ligninsulfonic Acid
BY W. R. KENZIE, P. A. DEUTSCH, AND J. BENKO, *Ontario Research Foundation*

9:30 a.m.—Ratio of Lignin to Vegetable Tannin Takeup from Blends in Sole Leather Tanning
BY J. H. DAVIS, R. BENNING, AND M. BAUM, *Marathon Corporation*

10:00 a.m.—The Use of the Infrared Spectrophotometer in the Tanning Industry
BY W. ROBERT LOTZ, *Albert Trostel and Sons Company*

10:30 a.m.—Degradation Studies on Collagen
BY JAMES W. CASSEL, *National Bureau of Standards*

11:00 a.m.—Tanning Studies with Oxystarch
BY E. M. FILACHIONE, E. H. HARRIS, M. L. FEIN, I. D. CLARKE, J. NAGHSKI, AND P. A. WELLS, *Eastern Utilization Research Branch, U. S. Dept. of Agriculture*

Tuesday Afternoon, June 4

R. STUBBINGS, *Presiding*

2:00 p.m.—A New Approach to Leather Lubrication
BY GEORGE H. VON FUCHS, *Consulting Chemist and Chemical Engineer*

2:30 p.m.—Complex Equilibria in Chrome Tanning
BY T. C. THORSTENSEN, *Research Foundation, Lowell Technological Institute*

3:00 p.m.—The Role of Salt in the Enzyme Unhairing of Hides
BY T. C. CORDON AND A. L. EVERETT, *Eastern Utilization Research Branch, U. S. Dept. of Agriculture*

3:30 p.m.—Leather Finish Adhesion Test
BY N. D. GALLAGHER, M. B. NEHER, AND V. VELY, *Battelle Memorial Institute*

4:00 p.m.—Impregnation of Sole Leather with Polymers
BY BERNARD FOUQUET AND JOSEPH R. KANAGY, *National Bureau of Standards*

Wednesday, June 5

F. O'FLAHERTY, *Presiding*

9:00 a.m.—Comparison of Water Resistance Tests
BY F. SIMKO, *E. I. duPont de Nemours and Company*

9:30 a.m.—Production of Leather Using Nonaqueous Systems
BY ALEXIS USHAKOFF, *Secotan, Inc.*

10:00 a.m.—The Relationship of Various Beamhouse Procedures to the Incidence of "Leopard Grain" Damage in Sheepskin Leather
BY E. J. STRANDINE, *Swift and Company*

10:30 a.m.—Some Observations Pertaining to Treatments of Leathers with Fungicides
BY S. DAHL, *National Bureau of Standards*

11:00 a.m.—Practical Bating—The Effect of Bating Variables on Side and Calf Leather Quality Based on Production Scaled Tests in Six Tanneries
R. STUBBINGS, *Lehigh University*; *S. B. Foot Tanning Company*; *A. F. Gallum & Sons Company*; *Ohio Leather Company*; *Pfister and Vogel Tanning Company*; *Fred Rueping Leather Company*; *and A. Trostel and Sons Company*

11:30 a.m.—The Use of Acrylates in Alum Tannage
BY C. W. BEEBE, W. F. HAPPICH, F. P. LUVISI, AND M. V. HANNIGAN, *Eastern Utilization Research Branch, U. S. Dept. of Agriculture*

CORRESPONDENCE

HOW ANCIENT IS OIL TANNING?

The following interesting letter has been received from Dr. G. A. Bravo, who very generously takes the time to prepare our abstracts from Italian journals.

Turin, Italy
May 10, 1957

Dear Dr. Merrill:

I always read with great pleasure the short notes and sentences which you put in every issue of *JALCA*, regarding some interesting and curious statements on the history of the leather industry.

For some 30 years I have regularly taken note of and collected all the notices of historical interest on leather, and I have already published some papers on these subjects.

Following the "Correspondence to the Editor" regarding the first use of oil tannage (cf. *JALCA*, **51,** 605, 1956; and **52,** 163, 1957), I may tell you that this kind of tannage was practiced as you stated, many, many centuries before King James's time.

Apart from the fact that it was perhaps the first kind of tannage employed by prehistoric men, early in the 8th century B.C. oil tannage was so well known that a receipt inscribed on a tile of the Assyrian kings' time (cf. Körner, *Collegium*, **1933,** 348) reports the following method: "You will treat the hide of a goat with milk and meal, and then with a fine oil, with a common oil, and with the fat of a pure cow, you will dissolve alum in the juice of the grape and treat the hide, and finally with a decoction of the gallnuts coming from the land of the Hittites."

I once made a study on leather making in ancient Egypt (cf. *Boll. Staz. Sper. Ind. Pelli*, **1933,** 75) where I reported that in many Egyptian tombs there are paintings reproducing the scenes of Egyptian life; among others, I reproduced the pictures of the tomb of Nevo-

thep, a general who lived under the Pharaoh Osortasen II (17th Dynasty). One of these pictures reproduces a scene illustrating oil tannage, with a hieroglyphic inscription meaning "The hide is very well fattened."

Yours sincerely,

G. A. Bravo

From the information thus received from Dr. Bravo, priority as to oil tannage seems to belong either to the Assyrians or the Egyptians. However, judgment should be withheld until we hear from our Chinese and Japanese friends—and, of course, from the U.S.S.R.—Editor.

ALCA-ASTM JOINT COMMITTEE ON LEATHER

Meeting February 14, 1957

A meeting of the Joint Committee was held on February 14, 1957, in New York, with 37 members present.

1. The name of Section 4, Subcommittee III (R. Ashcraft, Chairman) was changed from "Effect of Water" to the less ambiguous "Measurement of Water Resistance."

2. The committee decided that the laundering and dry cleaning tests fall within the scope of Subcommittee III, Section 5 (Surface Characteristics).

3. The committee agreed that cold crack should be a subject for both Mr. Kay's and Dr. Stubbings' committees to investigate (Subcommittee III, Sections 10 and 5).

4. Section 7 of the ASTM Methods was considered most suitable for the inclusion of leather tests.

5. The next meeting of the Joint Committee will be held sometime in October in Cincinnati. This will be a two-day meeting, with the first day's activities beginning at 2:30 P.M. Dr. Boor suggested that six weeks' notice should be given members prior to the next meeting so that all interested government personnel can get the proper clearance.

6. Reports of subcommittee activities were received as follows:

a) Subcommittee II—Sampling and Conditions for Physical Tests. C. W. Mann, Chairman. This subcommittee has prepared a proposed standard method for conditioning leather and leather products for testing. The draft was reviewed by this committee, and with slight changes it was approved. The corrected draft will be submitted to the Subcommittee on Nomenclature

and Definitions and later to the Editorial Committee before being submitted to the Joint Committee. The next matter to be considered by this committee will be the sampling of upper leather.

b) Subcommittee III—General Physical Testing. George Butz, Chairman.

(1) *Section 2—Physical Dimensions.* Dr. J. Naghski, Chairman. Methods on Determination of Area (ALCA, E-2) and on Determination of Width (ALCA, E-5) were approved and have been submitted for review to the Committee on Nomenclature and Definitions. Consideration is being given to incorporating proposed writeups on Thickness of Units (ALCA, E-3) and Thickness of Specimens (ALCA, E-4) into one method. By action of the Joint Committee, ALCA Method E-45 (Compressibility of Leather) has been transferred to Section 10 (Miscellaneous Physical Properties).

(2) *Section 3—Tensile Properties.* R. Young, Chairman. Methods for the Determination of Tongue Tear Strength (ALCA, E-10) and for Determination of Tensile Strength (ALCA, E-15) have been approved and are to be submitted for review by the Committee on Nomenclature and Definitions. In addition, the following ALCA Methods are being considered: E-13 (Stitch Tear, Double Hole), E-16 (Breaking Strength), and E-17 (Elongation).

(3) *Section 4—Measurement of Water Resistance.* R. Ashcraft, Chairman. This section has proposed to evaluate one kind of leather on the six machines which are presently being used for the measurement of resistance of leather to water penetration. Five members of the committee will furnish three samples each of two weights of shoe upper leather to be tested on these six machines. In most cases two laboratories will test samples on the same type of machine. Dr. Kanagy was appointed to head a group of ten to submit a method for measuring the water absorption of sole leather. Mr. Mann was appointed to head a group of six to submit a method for measuring the water resistance of glove leather. Dr. Chouinard was appointed to head a group of four to submit a method for the spray testing of garment leather.

(4) *Section 5—Surface Characteristics.* Dr. R. Stubbings, Chairman. The effects of scuff and abrasion have been temporarily tabled. Several subsections were set up to study the various phases of the surface program.

(a) Lightfastness Subsection. E. D. Compton, Chairman. A large-scale experiment involving about 1000 samples has been set up to determine the correlation between outdoor exposure in southern Florida and various accelerated tests including the Fadeometer and ultraviolet lamps.

(b) Wet and Dry Crocking Subsection. C. Geister, Chairman. Agreement was obtained that the present crockmeter was, in general, acceptable as a test method for dry and wet crocking. This subcommittee will attempt to work out the wording and exact procedures for an ALCA-ASTM method.

(*c*) *Flex Testing of Finish Subsection.* H. Haemisegger, Chairman. This subsection will study the present flex testing methods and propose a method or methods to cover light and heavy leathers.

The methods for studying effects of bleeding, staining, laundering, and dry cleaning on surface or color were all grouped together and will be studied to see if a single general method can be arrived at to measure the above effects.

(5) *Section 6—Fire Resistance.* Dr. R. Stubbings, Chairman. The study of this characteristic has been tabled until more interest has been indicated.

(6) *Section 7—Mechanical Leathers.* A. N. Compton, Chairman. The draft of Method of Test to Determine Corrosion Produced by Leather in Contact with Metal has been approved by Subcommittee I (Nomenclature and Definitions) and by Subcommittee V (Editorial) and has been submitted to the members of the section for a letter ballot. If the returns from the letter ballot are favorable, it is intended to send the procedure to the Secretary for presentation at the spring meeting and for submission to the entire membership.

The section members present also discussed in detail the proposed Test Method to Determine the Porosity of Leather Cup Packings. It was agreed to change the title of the procedure to Test Method to Determine the Oil and Air Permeability of Leather Cup Packings and to submit the title change and the entire test procedure to the section members for a letter ballot.

(7) *Section 8—Deterioration Effects.* Dr. S. S. Kremen, Chairman. It was found desirable to develop a simple test for the deterioration of insole leathers so that industry could evaluate the various insole treatments which are being marketed today. The use of plain water and one or two modifications of artificial perspiration will be used with regard to area measurements after repeated wetting and drying cycles. Procedures suggested by Charles Mann and Paul Oestreich will be considered.

(8) *Section 10—Miscellaneous Physical Properties.* Mr. A. N. Kay, Chairman. This section reported as follows:

Method E-43 (*Stiffness*). Committee members with the necessary equipment have been unable to do any work since the last meeting.

Method E-40 (*Break*). Mr. Bailey has suggested a machine for measuring this reasonably accurately. The committee will consider it and also see if it can be adapted to measure "pipe" of heavy leathers.

Method E-42 (*Cold Crack of Leather*). It was felt that this differed from Cold Crack of Finishes already being investigated in Section 5 and should be retained in Section 10 and considered by this committee.

Method E-45 (*Compressibility*). This is to be studied with particular reference to possible correlation with Durometer and Rockwell Hardness.

(9) *General.* It was suggested that an agenda be submitted by each chairman to his section for discussion before a committee meeting in order to obtain best results.

The method of procedure for progressive action of section and committee work was described by the Joint Committee as follows: Investigations within the scope of a section or subcommittee should be prepared for adoption, then transmitted to Dr. Lollar of the Nomenclature Subcommittee, then to Dr. Boor of the Editorial Subcommittee, and then to Secretary Battles, for obtaining a vote and approval. In case of a negative vote, criticism pertaining to substance should be reconsidered by the section commmittee, and editorial disagreement will be taken care of by the officers of the general committee.

c) Subcommittee V—Editorial. Dr. L. Boor, Chairman. A method submitted by Subcommittee III, Section 7 (Method of Test to Determine Corrosion Produced by Leather in Contact with Metal) is undergoing editorial review. This method will be rewritten to embody editorial corrections and submitted to the chairman of Section 7 for concurrence. After approval it will be sent to ASTM for printing and subjected to ballot of the Joint Committee.

The method of handling new test procedures submitted by subcommittees was outlined in the expectation of a considerable volume of test methods before the Annual Meeting in June.

M. H. Battles, *Secretary.*

ALCA-ASTM JOINT COMMITTEE ON LEATHER

Advisory Committee Meeting, February 14, 1957

A very brief meeting of the committee was held directly following the meeting of the Main Committee.

Dr. Compton requested that additional members be added to Subcommittee III, Section 5. Particular reference was made to the need for consumer representation for the work to be done on lightfastness. It was agreed that Dr. Compton should contact the following with the idea of obtaining active participation: Mellon Institute (Dr. Tobarth), Gimble's, Macy's, and Sears Roebuck and Company.

Dr. Boor was put on the committee because of his work on humidity control and its effect on fadeometer results.

Mr. Speight raised the question of a letter designation for tentative methods. The committee agreed that it would be necessary to do this immediately and concurred with Mr. Speight's suggestion that the D category would be appropriate.

M. H. BATTLES, *Secretary*

ALCA ANNUAL MEETING

The 53rd Annual Meeting of this Association was held at Lake Placid Club, Essex County, New York. At this delightful spot the meeting recorded its largest attendance to date. The large attendance was due in part to the pressure of many ladies.

Courtesy of The Leather Manufacturer

DR. HAROLD G. TURLEY, PRESIDENT OF THE INTERNATIONAL UNION OF LEATHER CHEMISTS' SOCIETIES (*LEFT*) AND GEORGE H. W. HUMPHREYS, SECRETARY OF THE SOCIETY OF LEATHER TRADES' CHEMISTS, OF ENGLAND

The Convention Committee provided an interesting and informative program. The number of technical papers submitted provided a full schedule for the three days. For this year the applied symposium was omitted.

The Presidential address was brief and very inspiring.

The invited guest speaker at the banquet, the Honorable Dr. Walter H. Judd, member of the United States Congress representing the Fifth Congressional District of Minnesota, held an audience of some 600 people almost spellbound while he extemporaneously reviewed the United States foreign policy.

The coveted Alsop Award was presented at the banquet to Professor William T. Roddy of the Tanner's Council Laboratory, University of Cincinnati.

Courtesy of The Leather Manufacturer

H. J. HODUS ACCEPTS WINHEIM AWARD AT LAKE PLACID CLUB

The Winheim Award was presented to Mr. Herbert Hodus, now of the Ohio Leather Company, for the thesis he presented at Lehigh University.

The response and reaction of those attending were so favorable that it has been arranged by Council to return to the Lake Placid Club in 1960.

COUNCIL MEETING MINUTES

June 2, 1957

Lake Placid Club
New York

A meeting was called by President Thorstensen at 4:00 P.M. All members were present except Mr. Weldon. Also present were Messrs. Wederbrand, Merrill, and Retzsch, and Secretary O'Flaherty.

The minutes of the Council meeting of January 11 were approved.

President Thorstensen appointed the following members to be tellers:

E. Presley
E. Stein
E. E. Doherty, *Chairman*

President Thorstensen appointed the following members to constitute the Nominating Committee for 1958:

C. Benrud
C. Telander
R. M. Lollar, *Chairman*

President-Elect Maeser reported on the report on methods status which he had sent to each Council Member. Upon motion made by M. Maeser, seconded by E. D. Compton, Council approved pages one to five inclusive of the report. Upon motion made by M. Maeser, seconded by R. Stubbings, Council approved a plan "to publish all the changes in methods from provisional to official on pages to be supplied to members for insertion in the front of the methods booklet."

Upon a motion by M. Maeser, seconded by E. D. Compton, Council rescinded its action of January 11 in reference to the method of publishing the "B" series methods, as recommended by the Committee on Vegetable Tannin Analysis.

Upon a motion by M. Maeser, seconded by R. Stubbings, Council approved the plan recommended where changes in methods of any significance are to be published on a separate page for insertion in the methods booklet.

It was reported by M. Maeser that Method "J40", previously approved, would be published at this time.

Upon motion made by M. Maeser, the matter of Council adopting a plan to pay for the statistical study of sampling, analyzing, and testing methods was dropped.

A request to Council for an author of a paper to be presented at this meeting to be granted permission to mimeograph his paper and distribute it to all members was not allowed. It was the feeling of Council that such matters should be handled as reprints of the article as it appears in the *Journal.*

Editor Merrill reported that at the present time it would appear that the *Journal* would be in volume about the same as in 1956 and that he had a reasonable backlog of papers.

Editor Merrill, who will go to the International Meeting, will delegate the *Journal* editing to Dr. Thomas Thorstensen for the period of his absence, about two months.

The following petitions were approved for active membership: C. L. Ornes, M. H. Olson, A. L. Buzzard, E. Bitcover, D. B. Taggart, and C. M. Tresfort.

Upon recommendation of the Chairman and motion by M. Maeser, seconded by E. D. Compton, Council approved the discharge of the Mechanical Leathers Committee, with the understanding that a member would be appointed to both the ALCA Physical Property Committee and to the Joint ALCA-ASTM Committee. Dr. Compton is to select and appoint this member.

Upon motion by E. D. Compton, seconded by M. Maeser, Council approved the method of handling Joint ALCA-ASTM methods when published. The motion moved that the Coordinator of the Technical Committees, with approval of the Physical and Mechanical Properties Committee, may accept, and approve use of the ALCA seal on, a method of the ASTM which consists of a restatement of an Official ALCA Method in the ASTM format.

Council adjourned at 4:30 P.M.

Respectfully submitted,

FRED O'FLAHERTY, *Secretary*

COUNCIL MEETING MINUTES

June 5, 1957

Lake Placid Club
New York

A meeting of Council was called by President Thorstensen at 2:00 P.M. Present were President Thorstensen; President-Elect Maeser; Council members H. Miller, D. Lord, and F. Zeissig; Messrs. Wederbrand, Retzsch, and T.

Thorstensen, guests; and Secretary O'Flaherty. Council members unable to be present were Messrs. C. D. Wilson and C. A. Martin.

Dr. O'Flaherty read the minutes of the meeting held on June 2, and Council approved them as read.

Journal.—President Thorstensen recommended the Association increase the advertising in the *Journal* to cover the cost of printing the *Journal*, including the Managing Editor's and Editor-in-Chief's expenses. Council considered this recommendation. Dr. T. Thorstensen advised he would inform Dr. Merrill of Council's suggestion. There being no additional business pertaining to the *Journal*, Dr. Thorstensen was excused.

Publishing of minutes.—Council discussed the delay in publishing the minutes of Council meetings in the *Journal*. It was recommended that a return addressed post-card ballot be sent with the minutes to each Council member for immediate approval of the minutes. The Secretary agreed to follow this policy.

Election.—New members elected to Council were Harold R. Miller, Charles A. Martin, and C. David Wilson. Council requested the Secretary in future elections to count and report the total number of ballots cast.

International meeting.—Mr. Thorstensen advised Council he had received a telegram from Rubin Borasky accepting with pleasure the award granted to him to present his paper in person at the International Meeting. A check was sent to Dr. Borasky. Mr. Thorstensen also acknowledged receipt of a check sent to him for the International Meeting.

Convention.—Council discussed the problem of limiting the presentation of papers at the annual meetings. A number of suggestions were given, and they will be sent to the Convention Committee for consideration.

The Convention Chairman was advised that it was felt that this was an outstanding convention from comments received from both members and the management of the hotel. The introduction of the invocation at the banquet met with much approval.

Exhibitors.—Mr. Wederbrand advised that the exhibitors were pleased with the location of the exhibits.

Convention sites.—The convention sites and dates for the next two years are:

1958—May 25–28, at Swampscott, Massachusetts
1959—June 14–17, at Mackinac Island, Michigan

Council agreed that Mr. Wederbrand should contact the Grand Hotel at Mackinac Island about the site of the exhibit booths.

Future meeting sites.—Letters from three possible sites for 1960 were discussed. It was brought to Council's attention that the Lake Placid Club is making plans to have a snack bar to serve between regular dining hours. Council agreed by motion of D. Lord, seconded by F. Zeissig, to return to Lake Placid Club in 1960 on June 19 through June 22.

Mr. Wederbrand will study one of the other suggested sites as a possible meeting place in 1961 and will submit his report to Council at the fall meeting.

Symposium.—Council discussed plans for future symposiums. Council approved a committee appointed by Mr. Thorstensen to study and report to Mr. Maeser on

1) a review of past symposiums,
2) what has been covered, and
3) the direction to be taken in the future.

The following committee was appointed and will be advised by Mr. Thorstensen:

Daniel Lord
Charles A. Martin
David Wilson, *Chairman*

It was agreed that the symposium should be held on the morning (9:00–1:00) of the third day of the meeting.

***Journal* advertising.**—Council discussed increasing advertising and contacting prospective advertisers. It was agreed that a special committee of the Ways and Means Committee be established. Mr. Wederbrand is to recommend the members of this committee and advise Mr. Thorstensen.

Nominating Committee.—The new Council reaffirmed the appointment of the following members made at the last meeting to the Nominating Committee for 1958:

C. Benrud
C. Telander
R. M. Lollar, *Chairman*

Awards Committee.—Mr. Thorstensen requested additional time before appointing the Awards Committee; Council agreed.

Exchange of journals.—Dr. O'Flaherty read a letter from the late Dr. Harvey requesting our Association to arrange an exchange of journals with the Indian Society of the International Union of Leather Chemists Societies. Council approved making the exchange.

Employment Bureau.—Mr. Zeissig suggested that the Association organize an employment clearinghouse at our annual meetings. This is to be considered by Council and discussed at the next meeting.

ASTM and ALCA methods.—Council affirmed that the Coordinator of the Technical Committees may grant permission to use the ALCA seal on ASTM tentative methods that are already ALCA provisional methods.

Next meeting of Council.—The next meeting of Council will be held on October 22, at the Sylvania Hotel, in Philadelphia, Pennsylvania.

There being no further business, the meeting was adjourned at 3:45 P.M.

Respectfully submitted,

FRED O'FLAHERTY, *Secretary*

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Two scholarships of $500 each are available each year through the Salem Oil and Grease Company in Salem, Massachusetts, which established the awards as a memorial to the late Harold T. N. Smith, a founder of the company. These are allocated to candidates enrolled in the Department of Leather Engineering according to scholastic ability and financial need.

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—*Gloves and the Glove Trade*. B. Eldred Ellis. London: Sir Isaac Pitman & Sons, Ltd., 1921.

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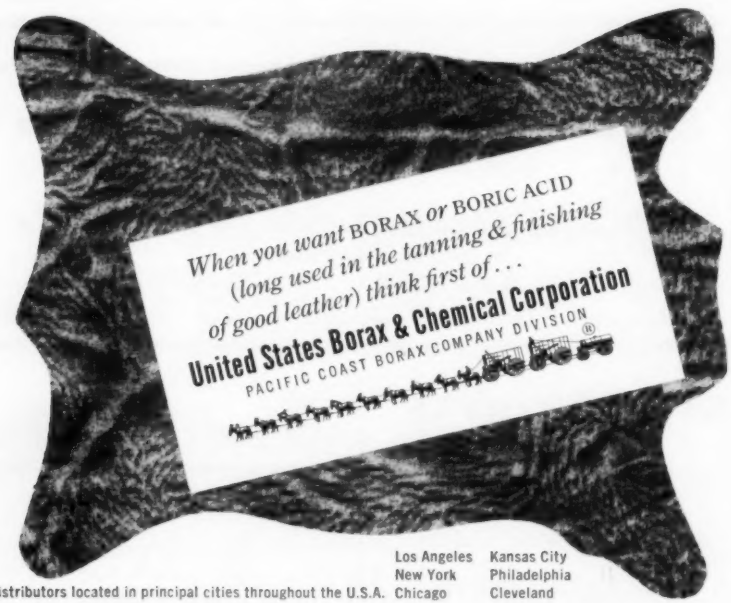
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